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W. J. JOHNSTON, Editor and Publisher.
T. COMMERFORD MARTIN, JOSEPH WETZLER, } Associate Editors.
G. H. STOCKBRIDGE, Assoc. Editor Patent Department.
CLARENCE E. STUMP, Business Manager.
WALTER T. HUNT, Advertising Dept.

New England Office, 48 Congress Street, Boston.
W. I. BARKER, Manager.
Western Office, 44 Lakeside Building, Chicago.
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Vol. IX. NEW YORK, JAN. 8, 1887. No. 2.

OUR correspondence from various parts of the country occupies a considerable part of the paper this week. It will all be found well worthy of perusal. It gives a vivid idea of the general activity in all the different practical applications, and offers many a useful hint and suggestion.

SUBWAY matters in New York afford a striking exemplification of the vicissitudes of human affairs. The subway commission already has its third president, but may not enjoy another year of life. The subway construction company has also undergone several changes of control and management, and now passes into new hands, the last reorganization being decidedly the best. Steady work may now be looked for, but it would be unwise to predict until after a few more conduits are laid and a few more poles disappear.

THE demand which exists for improved methods of train lighting, over those at present in use, is shown by the continued attempts to light trains electrically by primary batteries, such as the one described in another column. It seems strange, however, that this means should have been resorted to in the face of the present condition of well-known methods of generating and storing electrical energy.

IT is understood that experts have reported favorably as to the use of electricity as motive power on the Third avenue surface road. Conflicting statements are current, but there seems little doubt as to the main fact. Fulton street and Third avenue will be two good places for demonstrating what can be done with electric motors. What are the other cities going to do about it?

A SHORT note in another column gives the results of the experiments made by Mr. J. Brown in relation to the "contact theory" of electricity. It is shown therein that the chemical theory can be made to account fully for the phenomena displayed on bringing two dissimilar metals in contact. We may add that though only recently presented to the Royal Society, the experiments of Mr. Brown are cited in Sprague's excellent work *Electricity*, and compared with the other "contact theories" advanced.

IT will be seen from the items in the "Electric Light" department, on page 23, that there is no cessation in the work of organizing new electric light companies. In fact, it looks as though the movement gathered strength every week. Most of the large and small cities now have their streets lighted by electricity, but a great many others have yet to enjoy the benefit of the cheerful arc lamps on their thoroughfares. Beyond that territory lies the great 95 per cent. of artificial lighting—the indoor territory—and the steps towards its occupancy are being rapidly taken.

WE publish this week the new rates for lighting of the Boston Electric Light Company, dating from the beginning of the current month. The rates might well serve as standard, and they can be lived up to almost everywhere, if good service is given. Of course where competition comes in, the question is as to who will do most for nothing, but where the lighting is done on a solid business basis, these rates are entitled to a respectful consideration. If electric lighting companies giving good service would sometimes keep a stiffer upper lip, and have greater rigidity of backbone as to prices, they would be much better off.

MR. FORÉE BAIN makes some excellent points in his article, in this issue, on the desirability of more original work in electrical invention and research. He is right in advising the younger electricians to have their own lines of work, to be original as far as they can, to take nothing for granted, to prove all things, and to believe with the fervency of religious conviction that all the great electrical discoveries have not yet been made. As Napoleon said, the career is always open to talent, and that is certainly true in electricity, whether the talent be that of quick perception of leading principles or that of laboriously reaching important results.

THE recent researches regarding the construction of the dynamo have brought out prominently the relation which the space between the iron of the armature and the surrounding pole-pieces bears to, and the influence it exerts on, the general efficiency of the machine. Upon the suggestion of M. Cabanellas, the French have recently adopted the phrase *entre-fer* to designate this space which equals the diameter between the pole-pieces minus the diametrical cross-section of the *iron* in the armature. The French phrase seems to be quite appropriate and it is unfortunate that a literal translation does not suit our tongue. "Intraferal space" is not much better. The expression "air space," which is often used, is not only inexact, but is liable to lead to confusion with the mechanical "clearance." The London *Electrician* suggests the phrase "diamagnetic space" as appropriate and not liable to confusion and this is probably as good a one as could be found. Perhaps our readers can suggest something better, however, and we should be glad to hear from them regarding this point.

IT was natural that the gas question should be dealt with in Governor Hill's message to the New York Legislature. As he remarks: "There has been much complaint of late years in regard to the alleged abuses and extortionate charges on the part of gas companies. Such complaint has not been confined to any particular section of the State, although it has principally come from the city of New York, and the general desire to remedy it in that city found expression in several measures which were passed by the Legislature last year, three of which were approved, but one of which I felt compelled to veto. It is understood that the enactments which were approved have given a considerable measure of relief to the gas consumers of the city of New York without, so far as can be discovered, doing injustice to the companies. The bill which was disapproved was not only seriously defective in many respects, but it established a special gas commission for that city alone, rather than a State commission, and was, therefore, clearly objectionable. It also conferred upon such local commission certain extraordinary and dangerous powers." The Governor, therefore, proposes the organization of a State gas commission, whose supervision shall extend to electric lighting companies.

THE final and definite concession on the part of the local authorities for the building of an electric railroad in New York City must be looked upon as a great step in the application of electricity to railway propulsion in this country; and New York will hereafter be glad to be ranked as the pioneer among the large cities of the country in permitting the building of an electric railway in its busiest and most densely populated district. The system upon which work will soon be begun was fully described and illustrated in our last issue, and seems to embrace all the elements of success. If we take into consideration the large waste of power in the cable system, which ordinarily reaches and very often exceeds 75 per cent., and contrast this with the efficiency of the electrical system, without even entering into the disparity in first cost between the two systems, it cannot be denied that electricity must supersede the cable, just as the latter has in many places superseded the horse. The cable railway has not spread to such an extent as to make the introduction of electricity in its place a difficult one. With large traffic, cable roads have shown themselves to be decidedly more economical than horses, and the 80 or 90 miles of cable road in existence can be made electrical without great difficulty and with an absolute saving in the long run.

THE idea of connecting arc lamps in circuit with a self-inductive reactionary coil for the purpose of securing thereby a safety device is not in itself new, but Mr. J. E. H. Gordon, as shown in another column, now calls in mathematics to aid him in securing the best form of coil. The curious property of self-regulation, as it might be called, which is possessed by induction coils when placed on constant potential alternate current circuits, makes it possible to employ very low resistances in the primary coils of "secondary generators" or "converters." It would ordinarily be supposed that by connecting a coil of only a few ohms across the alternate current circuits at an E. M. F. of several hundred volts, a practical short circuit would occur, causing the destruction of the coil. But such is not the case, as practice has proved that the reactionary currents, caused by the mutual induction of the convolutions of the coil, are so great that they approach quite closely in intensity the original inducing currents, and being in opposite direction, prevent the passage of the current which would otherwise pass through a similar non-inductive resistance. The practical application of alternating currents on a large scale has brought out so many new facts that, in view of its probable extension, the study of the properties of the alternating current would appear to be a timely task.

SINCE the organization of the commission, the work of the Brooklyn Subway Board has been marked by great intelligence, and its action, tempered by forbearance, is a refreshing change from the general howl for the burial of the wires. The commission soon came to the rightful conclusion that nowhere did there exist an underground system of such comprehensive nature as would form the basis of comparison for an undertaking such as that contemplated by the law which the commission was created to enforce. Hence, it was wisely determined to move cautiously and develop gradually a system which might give satisfaction to all concerned. While the results obtained abroad in underground work are tolerably well known, a member of the Brooklyn commission, nevertheless, shrewdly deemed it of sufficient importance to investigate personally the conditions of similar affairs in Europe, and, though the investigation was a rapid one, it was sufficient to demonstrate that we cannot look to Europe for a solution of the underground problem, but must depend upon the experience gained and experiments made on our own side of the Atlantic. That this is a logical conclusion admits of no doubt, for the conditions existing on the two continents are quite different. Especially is this the case with reference to telephonic conductors, the proper disposition of which is the most perplexing question in connection with this subject. As Dr. Plympton points out, Europe can lend us no aid in this matter, for the disparity in the number of telephone lines here and abroad is too great to admit of any legitimate precedent being established from foreign practice. The report, which was printed by us last week, gives a good general résumé of underground work abroad, and the motive for and manner of its preparation does credit to the zeal and intelligence of the Brooklyn commission. Our New York commission will no doubt, take cognizance of the proceedings of its fellow workers and see the advantage of a gradual working out of an underground system best adapted to the requirements.

Originality in Electrical Invention and Research.

BY FORÉE BAIN.

It is but natural for the minds of men who are engaged in searching into the domains of nature's secrets to follow in "ruts" in the line of investigation. While the early investigators in the fields of electric science noticed passingly the phenomena of electric induction, there was no attempt made by them to utilize this peculiar and newly-discovered force. Electricity developed by chemical action seemed in those days to be the most promising field; in fact, it seemed more tangible, more material; and, as our honorable predecessors were unaccustomed to dealing with a force which could not be seen, there is little wonder that they chose the field they did, and all concentrated their energies on it. As a result, the electric telegraph, for example, soon became a practical every-day affair. Other inventions in which chemical electricity was applied followed in rapid sequence, such as the electric light, the arc, incandescent, and the light by static discharge.

Chemical electricity simply demonstrated the possibility of a few of these, but offered no solution of the problem of cost.

Then it was that the infant induction began to grow until it developed into the giant of to-day. The monster dynamos—the issue of induction—which send forth their powerful currents, that would be almost practicably impossible to produce by chemical means, are now so familiar that they scarcely attract as much attention as a good display of pumpkins at a country fair. The telephone, that delicate weak sister of the dynamo, a little inductive instrument, by which the "voice of man annihilates space," and the electric motor, are all of the same family.

The developments of the application of induction have been of greater benefit than seems within the possibilities of chemical or voltaic electricity.

But in the line of research in dynamic induction, there are a great many who tread the old "ruts."

There remain several other fields into which the workers may make fresh explorations. Static induction is a field in which the footprints of man are few, and yet through this agency we may ultimately dispense with the use of aërial wires. I will not dwell upon the possibilities, but call attention to the want of more earnest labor in this direction.

Atmospheric electricity, I believe, has not been utilized for any practical purposes. The differences of potential existing on one part of the earth's surface and on another will produce a current, yet it has not been practically applied. Electricity evolved by connecting points of the earth's surface which differ in potential remains a known yet valueless fact. Terrestrial electricity—or earth current—is of no more value, in a commercial sense, than when first discovered.

And who can point to a good work on magnetism? I open my dozen text books, which of necessity must say something about the loadstone, a piece of hardened steel, cobalt and nickel. There I find the same old wood cuts—a magnet with a lot of iron filings hanging on to the ends, and the points where these are thickest, we are told, are the poles. One of these books lays this down as a fundamental law: "If a magnet is broken into any number of pieces every piece will be a complete magnet, with poles of its own equal in strength to the original magnet." It is charitable to assume that this must be a typographical error. In a practical experiment I find the *sum of the whole to more* than equal the original. Again, the same text books all give an arbitrary location of the poles of a permanent magnet. They define the poles or points of greatest strength of a magnet as existing at or near the points of the same. But this is not necessarily so. I can locate the poles of an ordinary horseshoe magnet at *any point desired* without fracture or without electric action. It is a simple experiment that can be performed by anybody. One leg of the magnet can be made neutral while the other leg may be +, and the — pole may be located at or near the yoke. Again, the ends of each leg may be approximately neutral, and both poles may be moved up nearer the yoke of the magnet; and further, the neutral point on each leg may be brought down nearer the poles of the magnet. I have never seen a hint of this in any text-books, and only mention it to show that the study of magnetism has not yet exhausted the many unknown and startling facts that yet remain hidden. The reason simply is that there is too much following in the "rut." At another time I will take pleasure in explaining in THE ELECTRICAL WORLD in detail the peculiar transference of the poles of a permanent magnet.

Text-books do not keep pace with the rapid development of electric science. I quote the following from Hooker's *Chemistry*, 1871 edition, page 235, article 473:

"But galvanism can produce light without any chemical change taking place where the light is. For example, if there be fastened to the ends of two wires that come from a galvanic battery, points of charcoal, and these points be brought in contact, a splendid light will appear. Now here *is no combustion* of the charcoal, *for that remains unaltered.*" What a wonderful revelation to the electric light man of to-day, and what sad news to the carbon factories throughout the country!

What we need in our work is more individuality. The young seeker after knowledge should explore his own path, taking advantage of the land-marks of others when they are directive, but not until they are well scrutinized and thoroughly studied, and are found consistent with other facts well known to him. In many cases the work of others serves more to confound than to assist one in his own labors.

Individuality well developed and independence of thought, with enough firmness to continue in whatever field one may desire to occupy, will finally bring reward.

The records of the Patent Office show the sheep-like imitativeness of a majority of inventors. For a period the whole army of them are working on storage; then we find them at work on motors, following which we will probably have all of them toiling at incandescent lamps, and so on through the list. There are a certain class who have no individuality, originality or independence of thought, but who simply follow in the footsteps of the more able, taking for granted that all assertions are truths and not caring to investigate for themselves. Such people sometimes make "improvements" in minor detail, but their discoveries or inventions are never startling.

On Mechanical and Thermal Effects Accompanying Electrolysis.*

BY M. BOUTY.†

A series of short memoirs have been published by M. Bouty in the *Journal de Physique* on a branch of the subject not very immediately connected with that which at present concerns us. I had occasion to refer to part of them in a communication on the seat of E. M. F. in the voltaic pile. (*See* "B. A. Report," 1884, pp. 492 and 513, or *Phil. Mag.*, Vol. XIX., 1885, pp. 189 and 343 to 350.)

The references to them are as follows:

1. *On some mechanical and thermal effects accompanying electrolysis* (*Journal de Physique*, 1879, T. VIII., pp. 289 and 341).

2. *Thermo-electric and electro-thermic phenomena at contact of metal and liquid* (1880, T. IX., p. 306).

3. *On the contraction of galvanic deposits, and its relation with the Peltier phenomenon* (1881, T. X.).

In the first of these papers metals are deposited on silvered thermometer bulbs and the mechanical compression of the different deposits studied, Wertheim's results in elasticity being applied to them.

The effect of heat on such metalized thermometers is also discussed.

Metalized thermometers are then used as electrodes to examine the changes of temperature which occur while various ions are being liberated. During the electrolysis of $CuSO_4$ or $ZnSO_4$ the anode is slightly warmed, the cathode slightly cooled; inverting the current cools the new cathode distinctly. Electrolyzing dilute H_2SO_4 with platinum coated thermometers, the anode is quite warm, the cathode scarcely at all. This is the permanent effect. Inverting the current cools the old anode, sometimes $\frac{1}{5}$ degree below the temperature of the surrounding liquid. The effect can be repeated seven or eight times, although with decreasing intensity, if one takes care to stir the liquid between the inversions.

Replacing H_2SO_4 by HCl the permanent effect is very small, but both poles heat strongly at each inversion. With $PtCl_4$ one observes at each inversion a cooling of the old anode and a heating of the old cathode. In every case examined anode is hotter than cathode in the permanent state.

In the second paper, metal liquid junctions are warmed and cooled alternately, so as to give thermo-electric currents, the E. M. F. of several circuits being measured. An attempt is then made to measure absolutely the coefficient of the Peltier effect at these junctions when a current passes, a method suggested by Maxwell (*El. Electricity*, p. 146) being used. The result is that the author believes the effects to be purely physical, without known relation to the heats of combination or latent heats of solution, but connected exactly with the thermo-electric forces of couples corresponding. The thermo-electric laws of Sir W. Thomson are believed to apply without modification. Chemical effects are regarded as disturbances producing parasitic heats.

In the third paper, the author reconsiders the contraction of galvanic deposits in the light of the Peltier effect, and comes to the simple and satisfactory conclusion that the two phenomena are immediately connected. Each envelope being deposited at a rather higher temperature than it is able afterwards to maintain, a state of compression naturally results. This view he sustains by experiment.

Glow Lamps, Their Use and Manufacture.‡

BY MAJOR GENERAL C. E. WEBBER, R. E., C. B.

From the manufacturing point of view, the glow lamp consists of three distinct parts, namely: The filament, the wire mount or conductor, the glass bulb. The amount of research and experiment which has led to the perfection which now we may safely say exists in these three has been very large. It would be invidious to particularize individual labors, and the list would be too long to occupy the time of the present occasion. The burner, or bridge, has been the subject of a large part of these labors. The conditions which it should fulfill are various, and a good filament for the purpose has been produced from various materials. But the object of most inventors has been to find a highly refractory substance, and they have all ended in using carbon of either a fibrous or amorphous consistency, which they produce in the shape and of the nature which they require, by various processes. The conditions of form, density, uniformity of section, surface and electrical resistance, with which a glow lamp bridge must be endowed are now well understood. First, the form has been governed by the need to hold within a bulb of a given size a carbon wire of a given length. The simplest example of the means resorted to to achieve this is shown in this lamp, in which it will be seen that by giving the filament a coil, one of about seven inches in length is contained in a bulb only three inches in length, without unduly approaching the glass. Another condition of form is that of uniformity of section. With some of the raw materials used, it is almost impossible to obtain this in the early preparation without gauging them in a die, by means of which the irregularities of surface are scraped off before the thread or strip is bent into form previous to baking. This is the case with the material of the Edison filament, of the preparations of which, from especially selected bamboo in all its stages, we have seen beautiful examples at the Paris and Crystal Palace Electric Exhibitions. It is not the case with the filaments prepared by squirting a viscous solution of cellulose into a precipating solution, a process which produces at once the most perfect uniformity of section, such as that used for making the filaments, for instance, of the Victoria Brush glow lamp. It will be at once understood that the after stage of depositing carbon by the process discovered by Marcel Deprez is not essential to the obtaining of such uniformity in the latter case as it is in that of other inventors, who carve it out of raw vegetable material of either a fibrous nature, or out of strips of paper or parchment. Most of these raw materials are by way of being trade secrets; indeed, in the case of one glow lamp maker on the continent, I know that the inventor has never divulged his secret, and that he prepares the raw material in the privacy of home, and brings it to the works in such a form as almost to defy detection of its origin.

The raw material is generally wound on to blocks of carbon, and then baked at high temperatures. Here, again, we have a stage in the preparation of filaments which has given rise to a great deal of labor and research. The reasons for the varying results obtained from bakings were at first very obscure. With some kind of materials, filaments off the same blocks, and off different blocks, showed differences of contraction, causing fracture in the process, differences of tensile strength, and of surface, for which it was difficult to account.

Various means were adopted to regulate the rate of increase and decrease of the temperature in the oven, to exclude oxygen from contact with the baking, and the results as often misled the engineer as they helped to bring him to the desired standard process. All who have been through this will bear witness to how often they were disappointed, and how only by slow, steady, and patient investigations and collaborations of results they at length were able to deduce the conclusions which have led them to the true path which must be followed in the preparation and process of baking the raw material, from which they have seen no reason since to depart. To produce a carbon more or less dense and uniform has been the object of all, but if I have been understood, it is obvious that I attach the most importance to that process by which sufficient density and uniformity of section and surface are actually reached at this stage of the preparations of the filament.

We now have to study a stage which may be regarded as the most important with reference to the commercial use of the glow lamp. So early as 1878 it was discovered, or revealed, that in order to be able to use a large number of glow lamps on one system they must all be subject to the same electrical conditions of tension. It was found that it would be impossible to maintain uniform illumination in all the glow lamps on a system if each lamp was to be subject to different conditions of pressure; and that the only way to achieve a practical result was to connect one terminal of all the lamps to a main conductor conveying a current, in the first place, sufficient for all the lamps destined to be used in the system, and, in the second place, having an E. M. F., or potential, above zero (zero being an empirical "earth"), of an energy suitable to bring the filament to a state of incandescence; and so arrange that the value of the E. M. F. should be the same throughout.

In other words, the system of distribution known as the parallel system was thus practically discovered. The second or return conducting path is, of course, necessary when dealing with a physical development of energy, such as what we call "electricity," to complete the circuit to the so-called negative terminal of the dynamo or other source.

It will readily be appreciated that the word "parallel" is a misnomer, the parallelism of the conductors having nothing to do with efficiency; and that their being carried alongside of one another throughout a building only arises out of a desire to economize the labor of the workmen who have to put them up.

It would, I conceive, be well if the public, and above all

* *Journal de Physique*, 2e sér, September, 1885, T. IV. Communicated to the British Association.

† Brief Abstract, by Oliver Lodge.

‡ Paper read before the London Society of Arts.

the insurance companies (for it is largely a question of fire risk), could be brought to understand that the second or return wire is electrically the same as the "earth" of the electrician, and that so long as the positive, or supply wire, is well insulated and kept far apart from the negative, or return wire, no further precautions are necessary; and when they are thus far apart, even if one is bare, greater security is obtained than by the present system, which unreasoningly insulates the wire which need not be in a state of electrical tension, as well as that which is always ready to discharge. I have digressed a little way to show why absolute uniformity in the glow lamps is necessary to such a system; nothing in its condition could be made to compensate for any defect in that respect. The chief aim, then, must be to secure this uniformity in the manufacture of the filaments of glow lamps.

(TO BE CONTINUED.)

"Dynamo" Telephones.

Prof. Silvanus Thompson pointed out some time ago that in all probability the most successful solution of the problem of long-distance telephony, and also that of overcoming inductive disturbance, would result from the discovery or invention of a method which would enable us to employ a current many hundred, or even thousands of times stronger than those at present used in telephony. The plan is based upon the idea of utilizing an armature constructed very much after the pattern of an armature of a dynamo (either of the ring or drum type), and mounted between field-magnets. Instead of being capable of rotation, it is, however, supported upon an elastic axle, which permits it to vibrate to and fro over a small arc. To a point upon the periphery of the armature is affixed a pivoted bar, the other end being attached to the centre of a diaphragm.

Governors for Electric Motors.

BY A. W. MESTON.

IN THE ELECTRICAL WORLD of October 9 there appears a very clear and explicit description of Mr. Brush's governor which he has applied to his new motor. I read the article with a great deal of interest, inasmuch as I have lately given much study to the problem of governing electric motors. In the article referred to, it is stated with much truth that "steadiness of power and constancy of speed under all loads are two of the principal objects to be sought for," and the claim is made that "in the new motor these have been provided for in a very ingenious way." The ingenuity of Mr. Brush's device may not be questioned, but I very much doubt its efficacy, for I do not see how this governor can perform its duties in a satisfactory manner. The office of a speed governor is to govern or control, that is, to maintain in the subject governed a certain pre-determined standard speed by the judicious application of correcting influences. These correcting influences must be applied in such proportion as to neutralize any other influence which may tend to change the standard speed that is desired to be maintained, and should increase until the disturbing influence is entirely counteracted, and continue to be applied so long as the disturbing influence exists, even after the normal speed is regained. It appears to me that Mr. Brush's governor, as described, must fail to fulfill these requirements.

We will suppose that the motor is running at the desired speed with a certain load, and a change of load occurs. The governor, being simply a centrifugal balance, will be entirely unconscious of this change in the load, until, in consequence of such change, the speed changes. When a sufficient change of speed occurs to disturb the equilibrium of the balance, a movement of the governor and its adjuncts will take place. This movement will tend to check the change of speed, and will, at a certain point, check it; but it can never be sufficient to restore the original speed, for the reason that if the speed were restored, the governor must regain its original position, and this necessarily withdraws the influence which restores the speed. The partial gaining of the governor's object has the effect of overcoming its ability further to do so, long before the object is attained. The governor can only change its position by a change of the speed, and any attempt to keep the speed constant by applying directly the movement of a device which operates only when the speed changes and in direct proportion to such change, must, of necessity, prove ineffectual. Where a centrifugal governor is used alone the correcting influence exercised by it cannot be made proportional to the movement of the governor itself, with a view to keeping the speed constant under all loads. The motor will run at a different speed with every different load, and hence, to my mind, the principal objects, "steadiness of power and constancy of speed," have not been attained by Mr. Brush's governor.

I have attempted to overcome the difficulties in governing electric motors, and to eliminate, so far as caused by changes in load, the fluctuation in speed necessary to operate a centrifugal governor. As the load is the most important influence likely to disturb the speed of the motor, I think it but reasonable that it should exercise some direct control over the action of the governor; therefore I use the load in conjunction with a centrifugal governor, responsively connecting the pulley or other power-transmitting device with the governor, so that any increase of load will act against the centrifugal force of the governor, tending to draw its arms inward, and any decrease of load will, by an opposite action, let the governor arms fly outward a certain distance. Both these actions will take place without any change of speed and before any change can occur.

This method of governing electric motors is the subject of a patent issued to me on the 30th of last November. I believe that this governor will fulfill the most exacting requirements, and I have now almost completed a motor to test thoroughly its practical working. If successful, this should be a long stride toward the general introduction of motors in the present field of applied electricity.

Lighting Railway Cars by Primary Batteries.

We made mention lately of the fact that the train of sleeping cars between Lille and Brussels was now being lighted by primary batteries. The success obtained in this

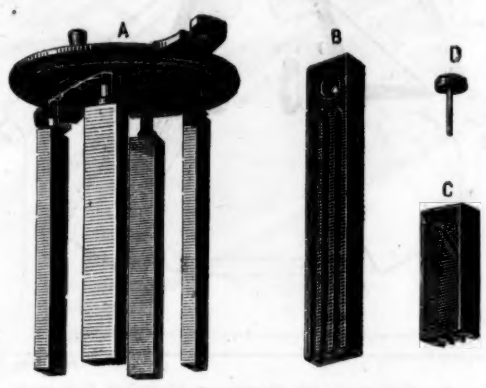


FIG. 2.—DETAILS OF DESRUELLES BATTERY.

instance has been such as to promise an extension of the system. The battery employed is that of M. Desruelles, and is of the Bunsen bichromate type. The illustration, Fig. 1, taken from *La Nature*, shows the cell partly in section, and Fig. 2 shows further details of construction. As will be seen, the outer compartment is a square box of ebonite covered with wood, the top of which is pierced by a hole of the diameter of the porous cup. The entire interior walls of the box are lined with carbons placed close together and corrugated so as to increase their active surface. The carbons are all attached to the walls by bolts, as shown in *B*, *C* and *D*, Fig. 2, which at the same time make connection with a copper band on the outside, which encircles the box and constitutes the positive pole.

The hermetic sealing of this part of the element is obtained by the porous cup, which is provided with a collar

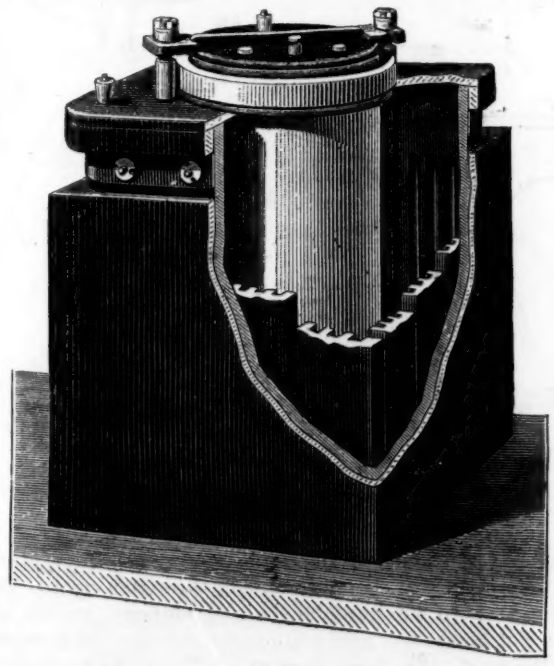


FIG. 1.—THE DESRUELLES BATTERY.

under which a rubber ring is placed. The escape of gas is provided for by the insertion in the cover of a thin glass tube held in a rubber stopper, shown at the left in Fig. 1, so arranged that the splashing of the liquid can not cause any escape of it. Finally the porous cup is closed by a cover from which the zincs are suspended, *A*, Fig. 2, being held in place by a cross bar and two bolts which compress the rubber ring under the collar of the porous cup. The cell is then so well sealed that it can be inverted without danger of spilling the liquid.

An interesting point in connection with the system is the amalgamation of the zincs, which is effected by a mercury paste, referred to by us in a recent number. This paste is composed of 300 grams of tallow, 25 grams of paraffine and 300 grams of mercury, ground or pounded and thoroughly mixed together. The depolarizing liquid employed is bichromate of soda dissolved in water to which sulphuric or nitric acid is added. The exciting liquid placed in the porous cup is a 30 per cent. acidulated solution of bisulphate of mercury. Charged in this manner, the cell has an E. M. F. of 2.19 volts and an internal resistance of 0.07 ohm, so that it gives 31 ampères on short circuit. Ordinarily it should only be called on to deliver six or eight ampères, at which rate it will deliver 200 ampère hours. The fall of E. M. F. amounts to only 5 per cent. after 35 or 40 hours.

The Sprague Experiments on the Elevated Railroad.

On Tuesday night, the 28th ult., were concluded the experiments which the Sprague Electric Railway & Motor Co. have been carrying on upon the 34th street branch of the elevated railroad in this city, preparatory to the undertaking of experiments on a much larger scale. Among those present were Mr. E. H. Johnson, President of the Edison Company; Chief Engineer Sloan, of the elevated railroad; J. D. Campbell, foreman of the elevated railroad shops; H. A. Webster, master car-builder; J. O. Morrow, Superintendent of the Sea View Railroad Co.; Charles H. Coster, of Drexel, Morgan & Co., and a few others.

Before beginning the run, Mr. Sprague explained that in the early part of the experiments the car would be run over the road making ordinary trips, then a variety of experiments would be performed, and, finally, the machines would be put to some very severe and exceptional strains. The experiments were made on the sidings and on the north track. At about half-past eight o'clock, the stations at the Ferry end of the line and at Second and Third avenues were brilliantly illuminated with a large number of Edison lamps, the current for which was supplied from the same source as supplied power for operating the car, the station being located in Durant's old sugar refinery in East Twenty-fourth street, half a mile distant. Connection was then made with the track, and immediately car No. 293, which was standing in a pocket, became brilliantly lighted. The switches being thrown over, the car was rapidly run out of the pocket on to the siding and switched over to the main track. It was then run up toward Third avenue, while the regular engine and car which had been on duty was run off the main track on to the siding. The first trips were uneventful. The car was smoothly and easily run between the ferry and Third avenue, sometimes stopping at the Second avenue station. At this latter point there is a 95-foot grade, which is the maximum grade that occurs at any station on the elevated railroad.

After several trips had been made, Mr. Sprague began to show some of the exceptional possibilities of his method of handling a car, the first of these being the starting and stopping, without shock or jar, on the ninety-five foot grade at the Second Avenue Station, the car being controlled solely by the motors and without the use of any hand or shoe-brakes whatever. After some running of this character, the speed of the car was increased until, when it was running on the upper grades, it was moving at about ten miles an hour; and occasionally, when coming on the down-grade, Mr. Sprague would allow the car to run at about eighteen or nineteen miles an hour.

The track on which the experiments were made presents difficulties, not only in that the middle station is on a heavy grade, but that just above this station, between it and Third avenue, there is a double curve on which the car leaves the straight track and runs into the Third Avenue Station. This curve is likewise on a grade. Notwithstanding this fact, the car ran smoothly and easily on every part of the trip, although not properly lined up, and hence with a great deal of friction on the side-bearings. On one trip, in coming down, Mr. Sprague stopped the car at the Second Avenue Station and then allowed it to creep at variable speeds down to the lowest perceptible rate of motion—a movement so slow that it would almost have been feasible to have gotten off the car and cracked a nut under the wheels, removing it before the wheels passed over it.

Later in the evening, the car was run rapidly past the Second avenue station on the down track, and between the station and the ferry was brought to a speed of about twenty-one miles, and while on the maximum down grade the car was suddenly slowed down and brought to a rapid, sharp stop in a distance of about one hundred and twenty feet. In another experiment the car was run rapidly up the grade, the current was shut off and the car allowed to run backward, when it was immediately stopped and run forward again solely under the operation of the current.

Toward the close of the experiments, Mr. Sprague put the car to some very severe tests. He explained that the motors which were then under the car were the original two, and were constructed for comparatively low speeds, their capabilities being about one-half of those of the motors which were on another truck that stood in a pocket.

On several trials the time was taken from starting to stopping between the Ferry end and the Third avenue station, a distance of nearly a third of a mile, and taking in the ninety-five foot grade and the double grade. On the down grades the time averaged one minute and fourteen seconds and on the up grades one minute and twenty-five seconds. The speed of the car was timed on the grade going up by counting the beats of the truck on the rails, and it was found to be running at twelve miles an hour, which is the normal rate of speed on the elevated road on a like grade.

Just before the close of the experiments, some very sharp strains were put upon the motors. These consisted in braking the car to its full motor capacity, which was done in going down grade and at the ferry end of the station.

With his regulating switch in one position, Mr. Sprague threw over the brake lever and instantly the car was brought up sharply and suddenly, with such a rapid gradation that the wheels on the trucks "skidded" in rotation on the tracks, and the car stopped in a fraction of its own length. These experiments were repeatedly tried, Mr. Sprague feeling that since this was the last of the present set of experiments, it mattered little if the machines were actually wrecked. He would at least, he said, find out what was in them.

Similar experiments were tried in starting. The car, when standing at a dead rest at the Ferry station, had the current suddenly given to it. There was an instant continuous "skidding" of the wheels, and the car actually jumped away from the station with such suddenness of acceleration as to nearly take a person off his feet.

The whole experiment was a great success in every way, both in showing that perfect control could be had of the car under any and all conditions under which it was operated, and also in showing the strains to which apparatus of this kind can be subjected in case of emergency. It proved the soundness of all of the principles involved in Mr. Sprague's system, and was watched with great interest by the practical men who were present, and who are best capable of judging of work of this character.

The electrical pressure used was about 600 volts. As Mr. Sprague explained, this was not the pressure that was necessary in order to handle a car or train of cars over this distance, but it is the electromotive force which is ultimately to be used in handling trains on the Elevated Railroad system; and he holds that it is useless to experiment with lower electromotive forces when the difficulties of the high pressures have all got to be met and overcome before any extended application of electricity to the Elevated Railroad system can be made.

During the entire experiments no brakes of any kind except the motors were used, and the car invariably responded to every touch of the operator's hand, the same apparatus being used to control the speed and power of the car as was employed in controlling its braking capacity. Notwithstanding the extraordinary character of some of the experiments which were tried, and the sudden and great strains which were put upon the apparatus, there was not a hitch of any description, nor was there any investigation necessary of any part of the apparatus. The commutators of the machines at the close of the run were bright and clean, the gears were in perfect condition and the whole apparatus was in proper shape for another run; this notwithstanding the fact that there had been but one previous trip made in five weeks, and that the motors had been standing on the track all that time.

Mr. Sprague is at present completing designs for a 200-horse-power motor truck, to have independent drivers and to weigh about seventeen tons, the whole weight to be upon the drivers; and he claims that this will have a capacity of handling five loaded cars, that is, a 100-ton train, and of making time on the "L" road. The same facility of control will, he claims, mark the operation of the larger machines as is to be had in the smaller ones.

The experiments on the Thirty-fourth street branch are for the present terminated, partly because of the difficulties attending the use of the present central station, which is equipped with old style machinery and was but a temporary make-shift, and partly because the Thirty-fourth street branch is so short that many of the problems that are involved in distance and which can only be settled over a longer line cannot be there illustrated.

Clausius on Electricity and its Relation to Heat.

In the German review, *Natur und Leben*, H. Klein, referring to a recent work of Clausius, mentions that the latter strongly insists upon the erroneous character of certain expressions which are in frequent use, especially the phrases "the transformation of heat into electricity," and the converse. Electricity, in fact, is *not* a form of energy any more than water or air; like these, it is merely a vehicle of energy, and cannot itself undergo transformation into either kinetic or potential forms of energy. These ideas are, of course, perfectly familiar, but it is to be feared that it will be long before practical electricians will see their way to modify their language in accordance with them. Clausius goes on to say that he is gradually becoming more and more convinced that we should cease altogether to talk of "ether," and should deal with radiant heat and light solely in terms of electro-magnetic reaction and of Maxwell's "electric particles."

The Fulton Street Electric Railway.

As we anticipated, the franchise for the North and East River Railway Company in this city has been obtained, the Aldermen by practically unanimous vote having regranted it over the veto of Mayor Grace. The company has begun active preparations to get the line working as soon as possible. The company, which is organized with Dr. W. W. Laman, President; R. W. Blackwell, Treasurer, and W. G. Smith, Secretary, has obtained the consent of the majority of the property holders along the route. The design of the line is to connect the principal railway ferries of the west side with Fulton Ferry at one fare, and to give easy communication between Washington and Fulton Markets. The line will be a double-track system running from the Fulton Ferry through Fulton street to the foot of Cortlandt street, and connecting with the foot of Chambers street on the one side and Burling slip on the other. The Bentley-Knight electric railway system, described in this issue and that of last week, is to be used.

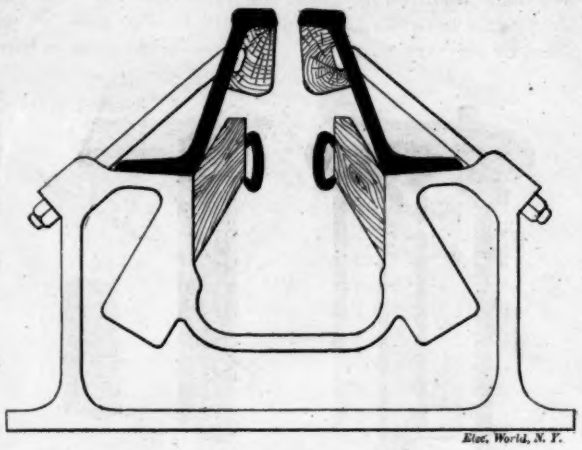


FIG. 3.—SECTION OF BENTLEY-KNIGHT CONDUIT.

It is claimed that the car, with a rounded front, can travel 15 miles an hour, or can be moved so imperceptibly as to force its way without accident through a crowd. The average speed will be about six miles an hour, and the absence of horses will give a minimum space to be occupied by the necessities of transportation. The projectors believe that this system will solve the problem of transportation in a crowded thoroughfare, and will restore prosperity to the old shopping establishments on Fulton street, which have suffered from the diversion of traffic to the bridge. In accordance with the amended Cantor act, it will take a month to advertise the franchise at public auction, but the company anticipates no opposition, and the entire plant and the cars are now being constructed at the Rhode Island Locomotive Works in Providence. Work will probably be begun the first of March, and it is confidently expected that cars will be running by April.

To Make Batteries.—The Uncle Sam Electric Light and Battery Company, of Portland, Me., has been incorporated with a capital stock of $500,000. Mr. S. T. Holmes, of Boston, is president.

"No Superior."—A small pamphlet, elegantly illustrated, has been issued by the publisher of THE ELECTRICAL WORLD, giving a brief outline of the origin, growth and development of that admirably conducted journal since its establishment nearly thirteen years ago. It has now, we think, no superior among the periodicals devoted to electrical science. Its main office is in the magnificent Potter Building, on Park Row, New York, with branches in Boston and Chicago.—*New York Mechanical News.*

Electric and Cable Railway Conduits.

As the chief rival to the electric railway at present is the cable railway, it is of interest to compare the two from a practical standpoint, both as regards the economy in first cost and in operation. There are about 87 miles of cable road in operation in the United States at the present time, more than one half of which has been constructed within the last five years, and the experience gained with the latter is sufficiently large to furnish a firm basis of comparison.

As regards the first cost, according to a well-known engineer, a double-tracked cable road laid in the best manner and supplied with girder rails will cost, exclusive of pavement, at the rate of $65,000 a mile; or, adding $25,000 a mile for first-class pavement, the cost will come up to $90,000.

With an electric road employing the conduit system, the cost, according to the estimates for a double-tracked road in this city, is $21,120 a mile; or, making the same allowance for pavement, less than one half the cost of a cable road. A comparison of the two conduits, as exhibited in the accompanying illustrations, will show the reason for this great disparity. Figs. 1 and 2 represent sections respectively of the New York and Chicago cable roads, and Fig. 3 a section of the electric conduit to be used in New York. Fig. 4 shows an isometric view of a double conduit employed on the electric system.

In the case of the cable roads, it is necessary to excavate for a distance of from three to four feet, and, in the case of existing roads to remove the cross-ties and renew the tracks; with the electric system neither the cross-ties nor the track need to be disturbed. This of itself is a large item in favor of the latter. This is clearly shown in Fig. 5, which represents an isometric view of the track and conduit complete.

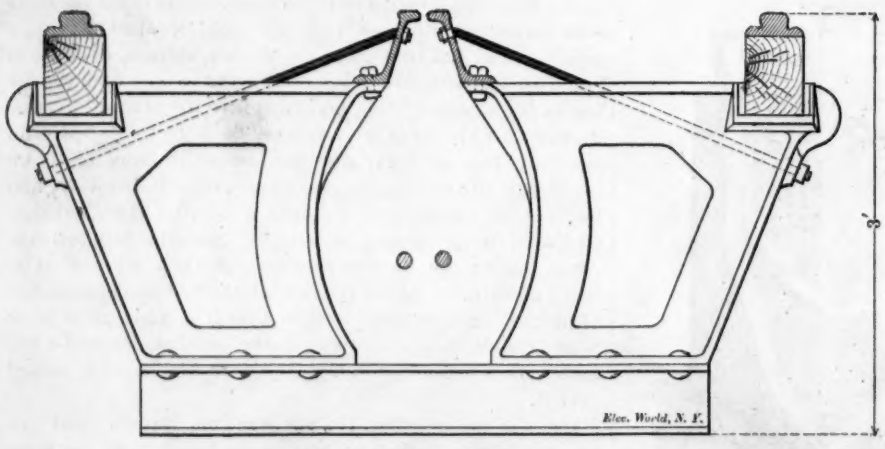


FIG. 1.—NEW YORK.

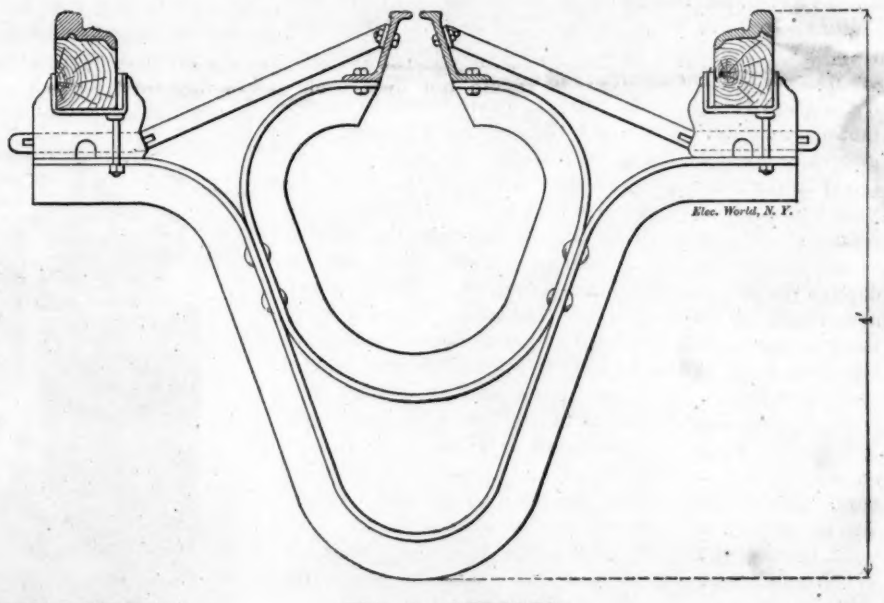


FIG. 2.—CHICAGO.

SECTIONS OF CABLE CONDUIT.

Electricity vs. Cables.

Under this heading the New York *Commercial Advertiser* publishes two letters bearing upon the subject of a report published by that journal, relating to the results of the committee of investigation of the Third Avenue Railroad. One of these, from the Bentley-Knight Electric Railway Co., contains the following:

"Referring to the synopsis you lately published of a report made by the Third Avenue Railroad's Committee after examination of the Bentley-Knight electric railway system, now in operation at the Rhode Island Locomotive Works, at Providence, we beg to say:

"It is stated therein that an electrically equipped street railway would cost 25 per cent. more to run than a similar road operated under the cable system; that twenty-five horse power per car would be required if the electric system were used; that electricity cannot afford so elastic a service as cables, and that the former requires a third more reserve power than the latter.

"On all of these points we take issue. If correctly quoted, the committee have evidently based their report on the assumption that as our motors can, on emegency, develop twenty-five horse-power, they must of necessity do so at all times. As a matter of fact our street car motor, under ordinary circumstances, develops about three horse-power, which means six horse-power at the engine—heavily loaded it will run up to ten horse-power at the engine, and under extraordinary circumstances, with maximum grade and load, may run up to twenty-five horse-power. All street railway men know that on comparatively level roads a full-sized street car requires an average of not over two horse-power.

"Any electric manufactory will furnish dynamos guaranteed to give 90 per cent. efficiency and motors to give 85 per cent. The engine will give 85 per cent., and the worst transmitter used between the motor and the axles could scarcely waste more than one-fifth the power. This leaves 52 per cent., and deducting 5 per cent. for waste in resistance of the line conductors, we get 49 per cent. as

commercial efficiency. The weight of our motor, together with the increased friction due to greater rigidity of frame, makes a Bentley-Knight electric motor car require an average of three horse-power applied at the axles. If by "counterbalancing" it is meant that electric cars cannot average up power, or, in other words, that the dynamo cannot supply a large number of cars—sometimes giving the bulk of current to one car and sometimes to others, and occasionally expanding in capacity sufficiently to meet the maximum draft of all cars at once—the committee have made a grave error. As a matter of fact the electric system possesses this advantage to a much greater extent than the cable road. It is a heavy strain on the cable when any large number of cars get 'blocked' on the out-

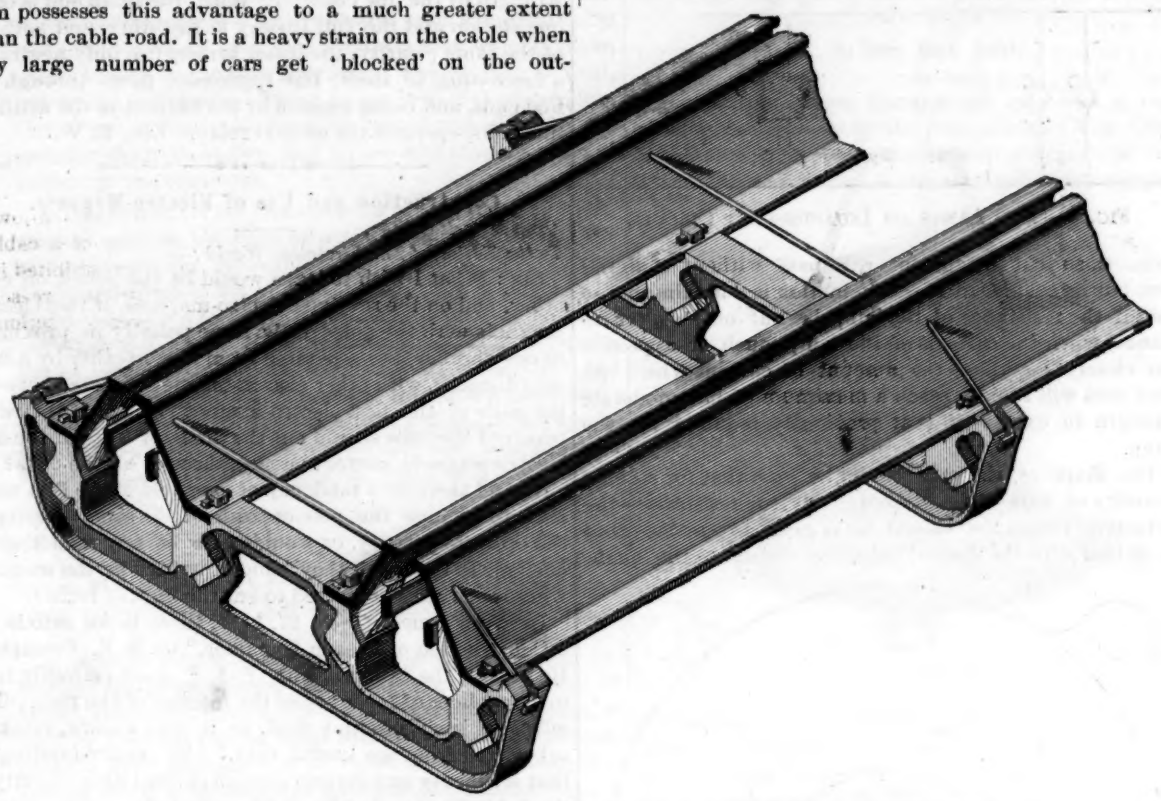


FIG. 4.—ISOMETRIC VIEW, DOUBLE TRACK, BENTLEY-KNIGHT ROAD.

going track, and cars so 'blocked,' although they can gain their relative positions by starting one after the other, can never make up the time lost. Such a block would occasion no difficulty to cars electrically equipped, for, as there is no strain upon the conductors at any time, it is immaterial how much cars are bunched or scattered, while the ability of each car to run independently and at any desired speed enables blocked cars to regain not only their relative positions but the time lost as well.

"As regards the question of reverse power, it is easily demonstrable that an electric power plant consisting of a number of separate dynamos and engines, each of which can in turn be cut out as the demand for power decreases, and which, in case of emergency, can be speeded up to take the place of any machine temporarily disabled, cannot labor under such disadvantages as attend a system like the cable, which requires as a reserve the doubling of its whole power plant.

"In the published synopsis an account is taken of the difference in first cost and the consequent difference in the construction charges to be borne by roads built under the two systems. The first cost of the cable is fully 25 per cent. greater than that of the electric road, and the saving in interest account made by the latter is too great to be disregarded.

"Its great first cost, its absolute dependence upon a single unit—the cable itself, its limited speed, the great waste of power when all cars are not in operation, the damage to health from the double open conduit sewer which can never be effectually cleansed, the great cost of turning corners, lubricating and repairing moving parts and of skilled labor to work the grips, and the impossibility of working turnouts, sidings, branch and cross-roads—all militate against its ultimate success, while none of these objections is applicable to the electric system."

Mr. J. Murray Mitchell, of the Safety Electric Railway and Power Company, operating the Daft system, in commenting on the same subject says, among other things:

"The report purports to state that the expense of electricity would be at least 25 per cent. greater than that of cables. As I consider that when matters of this practical nature are involved, mere theoretical statements are unsatisfactory, I will venture to give a few practical figures which I think will bear examination and the fullest discussion.

"I do not believe that any cable man will claim that a cable road of the length of the Third avenue line can be run with a recovery in the cars of more than 30 per cent. of the steam engine power, as friction and the enormous weight of the cable would consume more than 70 per cent. and probably 80 per cent. of the power generated in the steam engine. This item of expense is entirely done away with in the electric motors, and the road which has been running in Baltimore under the Daft system for over eighteen months, and which is alluded to in your article, proves by actual prolonged tests that the recovery of the power generated in the steam engine averages from 65 to 70 per cent. It must be remembered that this Baltimore road, while thoroughly practical in every respect, is nevertheless the first road ever equipped by electricity in this country, and in comparison with the improvements Mr. Daft has recently made, is extremely crude, so that in the future he will obtain even better results than that alluded to above. Most of the cable men that I have met admit that 80 per cent. of the power is consumed in operating the cable.

"From these figures it certainly would not seem, as stated in your article, that the amount of horse-power required to run a road by electricity would be three times as much as that required by cables, but the contrary. The only other ground on which such an assumption can be based is, that it would require at least twenty-five horse-power for each car on the Third avenue road if run by electricity. On what this estimate is based I do not know as no figures are given in the article, but as it is intended to run only ordinary horse-cars, which weigh about two tons and carry sixty passengers at the outside, it certainly would not require twenty-five horse-power to pull this load on the Third avenue line at the same speed that cables would pull it; say an average of eight miles per hour even when loaded to its fullest capacity. Daft's road in Baltimore has a grade of over 350 feet to the mile, and the motors make an average speed of eight miles per hour, their fullest capacity being only twenty horse-power. This road has numerous heavy curves and grades. There are very few grades on the Third avenue road, the greater part of it being almost level, and a motor of ten horse-power would be amply sufficient to average eight miles per hour on that road, and the power which would be consumed per car would not average more than about three horse-power.

"The electric road has in one way the same property that cables have, namely, that it calls upon the engine for just as much power as it requires to move the car. For instance, if a motor were ascending a heavy grade, say 7 per cent., and upon a sharp curve, the motor would call on the engine for the full ten horse-power, and would run then at a speed of less than eight miles per hour. On the contrary, if it were going on the level after it gained this headway it would ordinarily not require more than one or two horse-power, and on a down grade would theoreticaly be giving back power to the generating dynamo. Even if every car was equipped with a twenty-five horse-power motor, the same rule would hold good, and the car would only use so much power as was called upon to overcome the heaviest grades and loads, a car having such a motor as this being capable of ascending a grade of over 700 feet to the mile at a speed of three miles per hour, and going with great rapidity on the level. The Safety Electric Railway and Power Company, of which I have the honor to be counsel, are now building for a road in Pittsburgh five motors of a little over twenty-five horse-power each, which will be capable of pulling a load weighing 14,000 pounds up a grade of over 750 feet to the mile. We have guaranteed the successful working of these motors and an average speed of ten miles per hour."

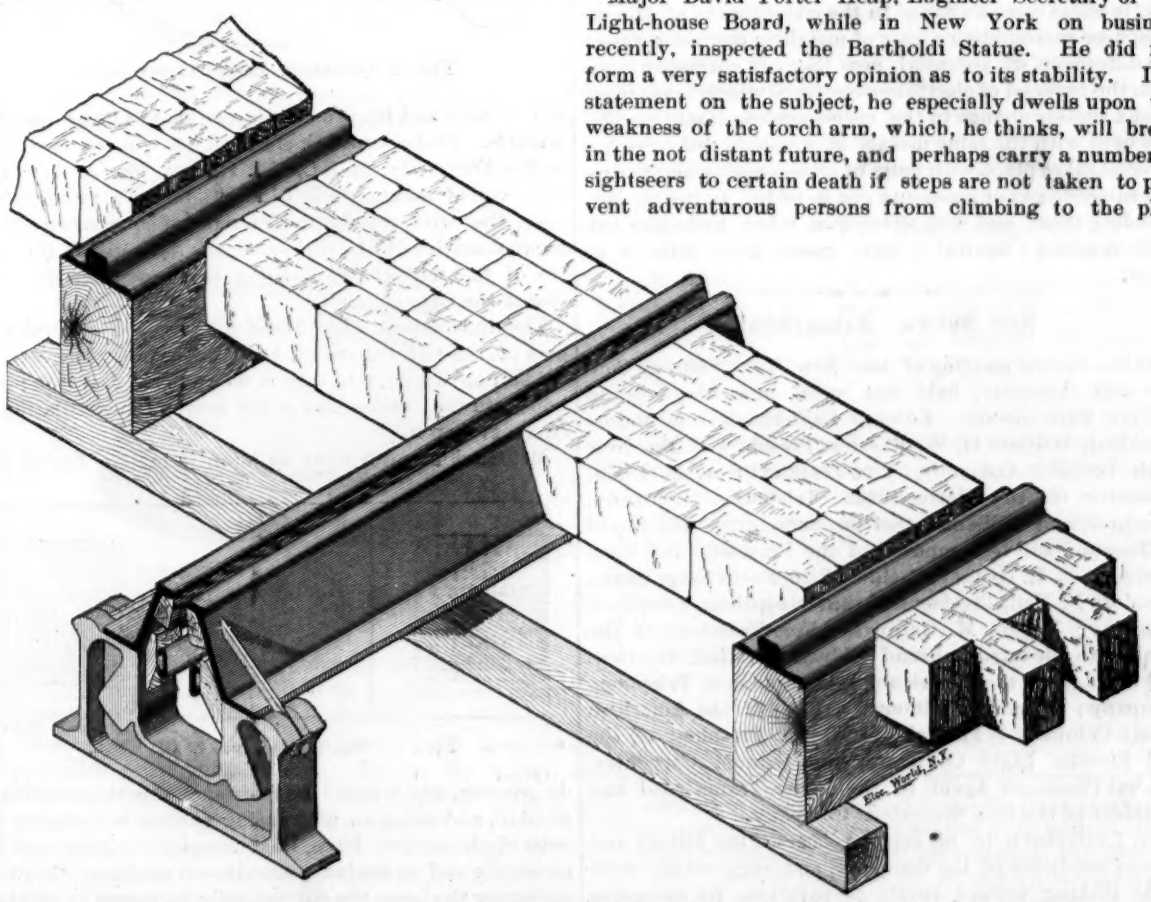


FIG. 5.—ISOMETRIC VIEW OF BENTLEY-KNIGHT TRACK AND CONDUIT, COMPLETE.

Rates for Electric Lighting in Boston.

The following is the list of prices with which the Boston Electric Light Company—formerly the Brush and Merchants' companies—begins the new year:

ARC LIGHTS.

1	Arc lamp,	Contract for	12	Months	.....	75	cents	per	day.
1	"	"	"	6	"	.....	80	"	"	"
1	"	"	"	3	"	.....	90	"	"	"
2	Arc lamps	"	"	12	"	.....each	70	"	"	"
2	"	"	"	6	"	..... "	75	"	"	"
2	"	"	"	3	"	..... "	85	"	"	"
3 or 4	"	"	"	12	"	..... "	65	"	"	"
3 or 4	"	"	"	6	"	..... "	70	"	"	"
3 or 4	"	"	"	3	"	..... "	80	"	"	"
5 to 9	"	"	"	12	"	..... "	60	"	"	"
5 to 9	"	"	"	6	"	..... "	65	"	"	"
5 to 9	"	"	"	3	"	..... "	75	"	"	"
10	"	"	"	12	"	..... "	50	"	"	"
10	"	"	"	6	"	..... "	55	"	"	"
10	"	"	"	3	"	..... "	65	"	"	"

INCANDESCENT LIGHTING.

For 125 candle-power lamps, in series of three.

Contract for	12	months	.....	each	50	cents	per	day.
"	"	6	"	.....	"	55	"	"	"
"	"	3	"	.....	"	60	"	"	"

For 60 candle-power lamps, in series of three.

Contract for	12	Months	.....	each	30	cents	per	day.
"	"	6	"	.....	"	35	"	"	"
"	"	3	"	.....	"	40	"	"	"

For 16 candle-power lamps, in series of eight or its multiple, special rates will be made.

The Stability of the Statue.

Major David Porter Heap, Engineer Secretary of the Light-house Board, while in New York on business recently, inspected the Bartholdi Statue. He did not form a very satisfactory opinion as to its stability. In a statement on the subject, he especially dwells upon the weakness of the torch arm, which, he thinks, will break in the not distant future, and perhaps carry a number of sightseers to certain death if steps are not taken to prevent adventurous persons from climbing to the platform around the torch. The Major says that he and a brother officer undertook to journey to the torch one morning. It is reached by a ladder standing directly upright in the arm, and is a most dangerous means of ascent. When on the platform, the Major says, his friend shook the arm so hard that he thought they would both be dropped from the torch. Major Heap says that if the statue is placed under the control of the board he will recommend that the arm be closed and only the points of observation around the head used by tourists. The statue is made of sheet copper, and Major Heap declares that it will be a constant expense to the government. After she has withstood the weather

for two years the goddess will begin to lose portions of herself. The metal, Major Heap says, will corrode more rapidly, exposed as it is to all sorts of weather, than people imagine, and even now it shows signs of corrosion in some places. In the opinion of Major Heap, the Goddess of Liberty will be a burden to the government and a continual source of worry to the officers responsible for its condition.

Gen. C. P. Stone thinks that any persons who are contemplating New Year's calls upon the Goddess of Liberty need not be deterred from making them by any fear that the goddess may drop them, together with her strong right arm, should they have the temerity to climb through it to the platform around the torch. In regard to Major Heap's misgivings about the goddess's strength and powers of endurance, Gen. Stone says:

"Major Heap is stated to think the torch arm will break in the not distant future. There is no statement as to whether he thinks the copper or the iron framework will fail. I do not think either will fail. That the ascent through the arm is uncomfortable is hardly to be wondered at; that it is dangerous for a man of ordinary strength and activity I do not think. I would venture to differ from Major Heap as to the rapid corrosion of the sheet copper. That metal differs greatly as regards oxidation from iron. Copper exposed to the weather oxidizes on the surface and a covering (like a varnish) is thus produced which protects the interior of the metal from the action of the air. The statue of St. Charles Borromeo, erected in 1697, was made of sheet copper just one-half as thick as that of which the statue of "Liberty Enlightening the World" is constructed. Yet that statue still stands without any sensible diminution of thickness after an exposure of nearly 190 years.

"I cannot see any reason for supposing that the exterior of the great statue should require any expense to the government. That a monument of art of any such proportions can be maintained without expense is not to be supposed, but the principal expense will be, I imagine, the painting, from time to time, of the interior framework of iron and steel. That should not be neglected any more than the painting of the iron and steel work of the Brooklyn Bridge or any iron building."

Contact Electricity.

According to a recent paper by Mr. J. Brown, communicated to the Royal Society by Lord Rayleigh, the difference of potential near two metals in contact is due to the chemical action of a film of condensed gas or vapor on their surfaces. Such a pair of metals is similar to a galvanic cell with its electrolyte divided by a diaphragm of air or other gas, and it is the difference of potential of the film that is measured in contact electricity experiments, the metals themselves being at one potential. Mr. Brown has observed that in some cases a change in the constituents of the atmosphere surrounding a pair of metals in contact reverses the difference of potential near them in correspondence with the reversal of electromotive force which takes place after a similar change in the corresponding liquid electrolyte used with the same metals in a voltaic cell. Such a reversal takes place with pairs of iron-copper when hydrogen sulphide gas or ammonia gas is added to the air surrounding them, and with silver-iron, when hydrogen sulphide is added; neutral or inert gasses have little or no effect.

New Subway Management.

At the annual meeting of the New York Subway Construction Company, held last week, new directors and officers were elected. Edward Lauterbach was chosen President, William H. Woolverton, President of the New York Transfer Company, Vice-President; A. S. Dodd, Treasurer of the Metropolitan Telephone Company, Treasurer, and William J. Sefton, Secretary. The Board of Directors will be composed of the President and Vice-President; E. E. Gedney, Cashier of the North River Bank; Theodore N. Vail, President of the Metropolitan Telephone Company; Robert M. Galloway, Vice-President of the Manhattan Elevated Railroad; Edward J. Hall, Jr., General Manager of the American Telegraph and Telephone Company; Richard A. Elmer, President of the American Surety Company; Frederick Lovejoy, President of the Ball Electric Light Company, and Samuel Carpenter, General Passenger Agent of the Pennsylvania road and President of the Iron Steamboat Company.

Mr. Lauterbach in his report rehearsed the history and present condition of the company, and suggestions were made looking toward ample preparations for extensive work in the spring. This work will be done by a subconstruction company, to be known as the Phœnix Construction Company. Mr. Lauterbach said that the names of its Directors would not be given to the public just yet, as the organization was not yet complete. It is expected that its composition will show the pro rata interest of the leading telegraph, telephone and electric light companies in the new method of work. It has already secured the contract for 800 miles of duct, and it will deposit a bond with the construction company as security for the faithful performance of the contract, which in turn will protect the bond of the Subway Construction Company with the commission. A Board of Engineers, composed of representatives of the companies, will select the materials for approval.

Arc Lamps on Incandescent Circuits.

One of the main difficulties met with in placing arc lamps on constant potential circuits, such as are employed in connection with incandescent lamps, is the danger of causing a short-circuit if from any cause the carbons approach too closely or come in contact. In order to avoid this difficulty on alternating current circuits, Mr. J. E. H. Gordon, the well-known English electrician, has applied an inductive resistance coil *E*, Fig. 1, inserted in the same branch as the lamps. This coil has a minimum of true resistance, so that the current will pass without material loss, but its coefficient of self-induction is a maximum; so that if the resistance of the lamp be cut out—as, for instance, when the carbons of the lamp touch or approach too closely together—the amount of current which can then pass will rapidly reach a maximum of but moderate strength in excess of that previously required for the lamp.

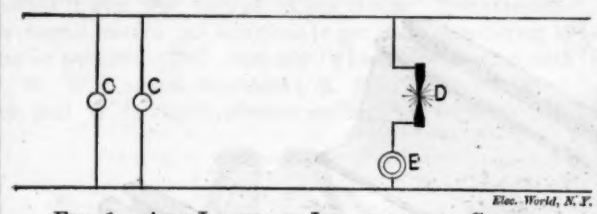


FIG. 1.—ARC LAMPS ON INCANDESCENT CIRCUIT.

The shape of the coil should be such that for a given quantity of wire—that is, for a given true resistance—the inductive resistance should be as great as possible—that is, so that with the desired inductive resistance the quantity of wire and the true resistance should be as small as possible. Professor Clerk Maxwell has shown (see Maxwell's *Electricity*, 2d Ed., Vol. II., Sec. 706, p. 316) that "the coil of maximum self-induction" is a circular coil with the wire wound in a channel of square section the mean diameter of the coil—*i. e.*, the diameter at the centre of the wire-channel—being three-sevenths times the size of the wire channel.

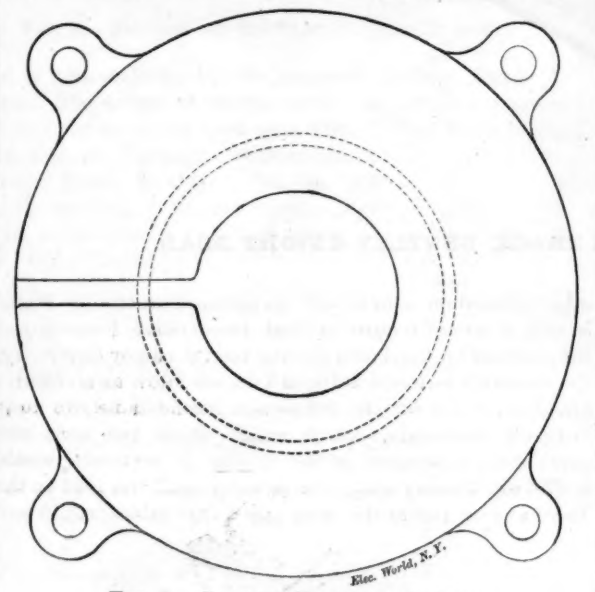


FIG. 2.—GORDON REGULATING COIL.

The illustrations, Figs. 2 and 3, show the general features of the coil employed by Mr. Gordon. The core, or bobbin, on which the wire is wound is of cast iron; it is hollow in the centre, and is slit to stop the circulation of currents therein.

Mr. Gordon states that with an inductive coil of this description, and whose true resistance was three-tenths of an ohm, and using an alternating current with eighty-six volts electromotive force, the current passing through the resistance and an arc lamp was sixteen ampères. On short-circuiting the lamp the current only increased to nineteen ampères, whereas with a non-inductive resistance of three-tenths ohm it would have risen to two hundred and eighty-six ampères.

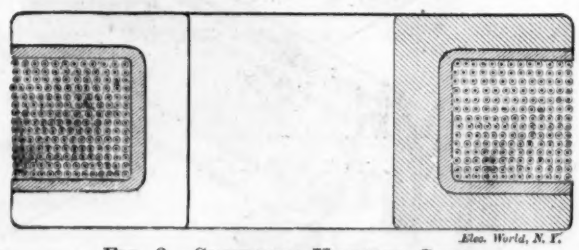


FIG. 3.—SECTIONAL VIEW OF COIL.

The inductive resistance may be placed at the point where the branch to the arc lamp leaves the main, in which case it acts instead of a fusible cut-out in preventing undue heating of the branch wires if a short-circuit should take place. This is an advantage, as it is well known that fusible cut-outs cannot conveniently be used with arc lamps.

In case the wires for several lamps branch from one point, care must be taken not to put the inductive resistances close together. They should be six or eight inches apart at least. If close, their mutual induction causes the lamps to flicker.

Quadruplex Questions.

To the Editor of The Electrical World:

SIR: (1.) In a Stearns quadruplex, suppose the pole-changer at one end of the line sends a positive current to the line, and the one at the other end puts a negative current to line, what is the effect? (2.) If they neutralize each other, is there still sufficient strength in the long end of the battery to operate the neutral relay? READER.

JUNCTION CITY, Mo.

ANSWER.—(1.) The currents combine, increasing the strength of the line coils. (2.) When the small end is on at one station and the full battery at the other, and both are of the same polarity, the lesser battery can only neutralize a force equal to itself, the remainder flows through the line coils, and being assisted by the current in the artificial line coils, operates the neutral relay.—EDS. E. W.

Construction and Use of Electro-Magnets.

To the Editor of The Electrical World:

SIR: What I wish to learn would be the effect on each other, and on the revolved electro-magnets, if two electro-magnets with the poles of the same polarity in proximity to one another, but separated from one another by a suitable distance, with other electro-magnets situated between the poles of the first electro-magnets, so that if they were revolved the coils should cut the lines of force of the first electro-magnets, current passing through all the coils?

Would there be a tendency of one pole of the first magnets to change the pole opposite of the same polarity to the opposite polarity, or would there be any induction of one pole to the other, they being separated by the magnets whose coils are so revolved to cut the lines of force?

In your issue of Nov. 27, 1886, there is an article on "Construction of French Dynamos," by R. E. Crompton. He says, "The cast-iron hub * * * must certainly tend to divert lines of force across the interior of the ring. The effect of such internal field, as is well known, must be subtracted from the useful field." My understanding is that whenever any certain portion of the hub is directly in the field of force of either field magnet the tendency is to make the hub of the opposite polarity, and hence induce a current in the coil exactly opposite to the one induced by the field magnets—with a tendency to reduce the intensity of the field.

Suppose that a piece of brass, or any other non-magnetic metal, was introduced between the pole-pieces of a sounder and its armature, would the attraction for the armature—allowing it to be of considerable thickness—be any less than if the air only separated them—the distance being the same in both cases?

In the article published some time ago on "A Systematic Mode of Inventing," one rule is laid down that for an electro-magnet to have its maximum force, the core should be about eleven times longer than the diameter. Does this mean the amount covered by the coil or the whole length of the core? For instance, can an electro-magnet six inches long have one or both poles extended six inches further, and, if desired, have the mass of the extension larger than the core and still retain the magnetic force? If the magnetism decreases as the pole recedes from the part covered by the coil, what is the ratio?

NOBLESVILLE, Ind. C. E. O.

The Gas Companies and the Electric Light.

To the Editor of The Electrical World:

SIR: In an article headed "Gas and Electricity," quoted in your issue of the 25th inst., the impression is given the reader that the American Electric Manufacturing Company, of New York, has effected an arrangement with all the gas companies of the country by which the interests of the gas and electric light companies will be mutual; and the statement is made that Mr. Goff, the President of the American Company, is the originator of the project.

The article referred to is so ingeniously worded that it is not supposed to be an advertisement of the American Electric Manufacturing Company. Whoever may be responsible for the statement made, this company denies the truth of it, and desires attention called to the fact that hundreds of "Fort Wayne Jenney" lights were being operated by gas companies years before the American Electric Manufacturing Company was in existence.

We make the further claim of having been the first electric light company in the field to see the advantages of combining the gas and the electric light interests, and representatives of this company were the first to broach the subject to many of the gas companies that have since adopted our and other systems of electric lights.

That many of the other electric manufacturing companies have of late pursued the course which this company has always advocated is proof of the wisdom of such a course, and the fact that a larger number of gas companies in the country are operating lights of our manufacture than the American Company can show, disproves the statement made that Mr. Goff "is thus far alone in his advanced position."

The more progressive gas companies of the country are fast falling into line and putting in good systems of electric lights, but as far as known only two gas companies

have adopted the old revived "Fuller-Wood" apparatus, which is all the American Company has to offer them. By giving these facts publicity you will oblige.

FORT WAYNE JENNEY ELECTRIC LIGHT COMPANY,
R. T. MCDONALD, Treasurer.
FORT WAYNE, Ind., Dec. 29.

The Dann & Lapp Telephone.

To the Editor of The Electrical World:

SIR: In a recent number you gave a description of some of our telephonic apparatus, and in Figs. 2, 3 and 4 illustrated an instrument. You will find upon examination in the patent where that device is shown that we only claim an electrode; we show an instrument where it may be used, but do not say that we intend to use it in that connection. Our object in that patent was to secure protection for the metallic electrode shown, and its use is to take the place of carbon in the telephone.

In our system of the transmission of speech by an intermittent current, the current is made and broken by the electrodes of the transmitting instrument. Now, this make-and-break is not—as is the case of a number who claimed a make-and-break transmitter before—a matter of theory, but the noise made by the motion of the electrodes can be heard—as in the case with the Reis—several feet, and during this time perfect, articulate speech is transmitted; and, further, we prove this separation of electrodes breaks the current. The instruments we use, one was patented March 23, and shown by you in Fig. 1, and another on Aug. 24, both 1886. DANN & LAPP.

HONEOYE FALLS, N. Y.

A New Method of Forming Secondary Battery Electrodes.

In order to secure a strong and efficient electrode for storage batteries, Victor Sass and Karl Friederich, of Berlin, Germany, have devised a method which consists of melting lead and zinc in equal parts, and heating this composition until oxidation of the lead sets in, and then dissolving the zinc by means of dilute sulphuric acid.

The lead and zinc are first melted together in equal parts, and the composition is then heated, under constant agitation of the same, until a uniform pliable mass is produced. By the process of heating the composition of zinc and lead the latter is fully oxidized, and then the entire mass, in its heated state, is rolled by means of heated rollers into plates of the desired shape and form. After the plates have cooled, the necessary carbon conductors are secured to the plates, and the latter are then placed for a few days in dilute sulphuric acid. The latter dissolves the zinc entirely, and only the lead oxide remains in a well-divided state, so as to be specially effective for receiving and discharging the current of electricity which passes through the above-mentioned carbon conductors. The plates thus formed and prepared can then be employed in the usual manner as electrodes for accumulators and secondary batteries. The strength of the electrodes or plates can be changed by increasing or diminishing the quantity of zinc.

Telegraphs in Queensland.

According to the report of the Post and Telegraph Department of Queensland, Australia, for the year 1885, the number of telegraph offices in operation at the close of the year was 259, of which 36 had been established during the previous twelve months: 12,608 miles of wire, and 7,537 miles of posts had been erected, while 3,006 miles of wire and 1,567 miles of posts were in course of construction. The gross revenue amounted to £99,980, and the total expenditure to £92,932. The expenditure for maintenance and repairs of lines during the year amounted to £5,480. The total amount expended in construction of lines up to the end of last year amounted to £599,453. Iron poles are very largely employed, and give great satisfaction; in certain districts they are frequently bent by the force of the gales, but it is stated that they can be straightened again without difficulty. In October last quadruplex working was established between Brisbane and Sydney, and another quadruplex line will shortly be worked to Bowen. Two or three lines are also working duplex. The Department has established four telephone exchanges, of which Brisbane has 356 subscribers, and the others about 50 each.

French Dynamo Designs.

In a recent issue of *L'Electricien* M. R. Arnoux has a paper criticising somewhat the note recently presented to the Académie by M. Marcel Deprez on the magnetic circuit, which appeared in our issue of Dec. 4. M. Deprez affirms that "contrary to the views of many electricians, the intensity of the field decreases much less rapidly than the distance of the poles increases." But M. Arnoux points out that according to the figures given by M. Deprez himself, the whole of the experiments upon which this conclusion was based were conducted with exciting powers far beyond the saturation point of the iron. In fact, in well designed machines field magnets of the same dimensions as those employed in the experiments would be excited with an expenditure of energy not exceeding one-eighteenth of that actually expended by M. Deprez. Under these circumstances, the observations cannot be considered to have any bearing upon the practical questions to which M. Deprez wishes to apply them. In the course of his remarks M. Arnoux mentions that he has himself experimentally established the following theorem: In a machine of given dimensions, and for a given exciting power, there is always a certain value for the diameter of the inter-polar space, and one only, for which the output of the machine will be a maximum, and one other value, and only one (always less than the former), for which the commercial efficiency will be a maximum.

A New Box Bell.

The accompanying illustrations represent a new bell recently brought out by the New Haven Clock Company, of this city, and possessing several features of novelty. As will be seen in Fig. 1, the mechanism is mounted upon

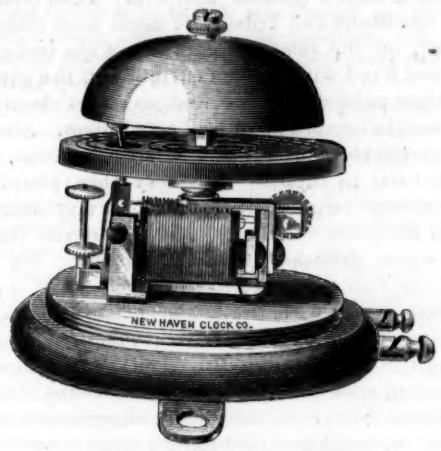


FIG. 1.—NEW BOX BELL.

a wooden base and covered at the top by a circular cap. After being screwed in position the cylindrical jacket is screwed into place when it completely incloses the bell, rendering it entirely dust proof, as illustrated in Fig. 2. With this disposition the different parts of the bell can be inspected from all sides.

The bell mechanism is so arranged that the turning of the thumb nut and cam, shown at the left in Fig. 1, converts the bell into the vibrating or single stroke type at will, without changing any connection of the wires.

Death of Hilborne L. Roosevelt.

We have to record, with great regret, the death on Dec. 30 of Hilborne L. Roosevelt, one of the largest organ builders in this country and in the world, and a well-known inventor of electric appliances. He died at his residence, No. 58 West Eighteenth street. He was 37 years old, and was born in this city, being the son of the late S. Weir Roosevelt. While still very young he studied

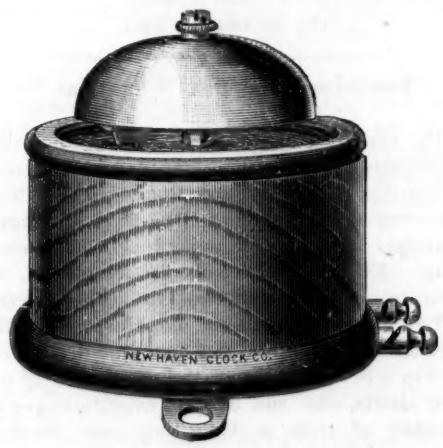


FIG. 2.—NEW BOX BELL.

the manufacture of church organs in this country, and then made several trips to Europe to study the manufacture from an art standpoint, and at the same time he identified himself most particularly with electric inventions as applied to organ manufacture. Among the organs that he built was the one in the Garden City Cathedral, and also the one in Grace Church, this city, each of which has 20 miles of electric wire in it. He also built the Trinity Church organ, and the organ in the main building of the Centennial Exposition of 1876. He started his organ factory first at No. 40 West Eighteenth street, and then moved it to No. 145 in the same street. He also established factories in Philadelphia and Baltimore. Mr. Roosevelt invented several important details of the telephone, and up to his death was in receipt of royalty. At one time he was largely interested in the New York Bell Telephone Company, but withdrew from financial telephonic development at an early stage. He was also largely interested in the Leclanché battery, the factory of which is in the same block of buildings as the organ factory. He was widely known in electrical circles, and was an intimate friend of Mr. Edison. His death was caused by a complication of disorders, aggravated by pleurisy. He leaves a widow and daughter. The employés of the deceased at a meeting last week passed resolutions of regret and sympathy, a copy of which was sent to the family.

On the Employment of Alternating Currents for Measuring Liquid Resistances.*

BY MM. BOUTY AND FOUSSEREAU.

The authors criticise the employment of alternating currents employed by Kohlrausch and many others in the hope of diminishing the effect of polarization. They point out that self-induction in the resistance-box is fatal to silence in the telephone [naturally], and only succeeded in getting good results when they replace wire in their bridge by liquid resistances, describing for this purpose a liquid rheostat. Even thus, however, they hardly get concordant results when they try to apply the method to extremely weak solutions.

The Telegraph Pole as an Advertising Medium.

The great advertising medium of Chinatown, says the New York *Sun*, is a telegraph pole in front of the Wo Kee store in Mott street, a few doors from Chatham square. The pole is about two feet in diameter, and it is always girdled by a belt of advertisements written in Chinese characters on sheets of yellow, white or fire-cracker red paper. The girdle is three or four feet broad, and thus the available advertising space is from 18 to 24 square feet. This does not suffice for the needs of Chinatown, and another telegraph pole on the other side of the street, out toward the corner of Park street, gets part of the business.

When the Chinese avail themselves of this advertising medium they are reminded of the perversity of this western people in doing almost everything in a way diametrically different from their time-honored oriental method. There is never any doubt as to the circulation of this advertising medium, for nobody claims that it circulates. It stands there year in and year out, and the readers do the circulating. Thus there is no chance for hocus pocus. It is possible that, with their not very exact ideas as to modern western appliances, they may suspect that there is some beneficial influence in the mysterious buzzing that is heard up among the lofty wires. The prohibition "Post no bills" does not appear on the pole. If it is there, is covered up by many thicknesses of "dead ads."

On Sundays, when the Chinese from all parts of the city flock to Chinatown to pick up the week's news concerning their race, each visitor steps up to the pole and consults the announcements made thereon. They run largely to for sales, to lets and wants. When a Chinaman has anything for sale, from a laundry to a pair of chopsticks, he pastes an announcement on the big telegraph pole. Comparatively few of them are able to write the notices themselves, but they know where they can find scribes who will do it for them in good shape for reasonable pay. The notices are almost invariably written with admirable neatness, and without display. No cuts are inserted. There seems to be an understanding that no man shall occupy more of the common space than a reasonable setting forth of his announcement requires.

Two New Books.

It will be seen from full announcements made elsewhere in the present issue that two new books, dealing with important yet widely differing departments of electricity, have just been published from this office. The first is "The Electric Motor and its Applications," by the associate editors of THE ELECTRICAL WORLD. It is a quarto, of over 200 pages, with 200 illustrations, and in its treatment of the subject comes down to as late a date as December, 1886. The rapid development of the electric motor has created a demand for books on the subject, and the work referred to has been prepared with the object of meeting the want. The other book, "Static Electricity," by Dr. Atkinson, who has made this branch a life-long study, deals exhaustively with a most interesting and somewhat neglected field of investigation. The book is 228 pages 12mo, and contains 64 illustrations. Both works bring to notice the latest theories and application, and should be found helpful by the student and the practical man.

Grand Rapids, Mich.—On Dec. 30 a company was organized, with a capital stock of $200,000, to be known as the Grand Rapids Edison Light and Fuel Gas Company. The officers elected were D. McCoy, president; W. F. Bulkley, vice-president; W. R. Shelby, treasurer; C. W. Watkins, secretary, and T. J. O'Brien, attorney. Henlon triple gas generators will be used in the manufacture of fuel gas. An Edison central station will be built as soon as milder weather will permit. The gas plant will be built thereafter.

Subway Work.—The Subway Construction Company held a business meeting on Jan. 4, and further arrangements were made to have everything ready for the resumption of work in March The Board of Engineers, which will examine into materials and make the suggestions, has been completed in so far that Engineer Beckwith, of the Metropolitan Telephone Company, has been chosen chief engineer and Engineers Davis and Thomson consulting engineers. Whether this board will also represent the Phœnix Construction Company cannot yet be stated, as the composition of that sub-construction company is not yet ready for publication.

* Abstract of Proc. Royal Soc.

Practical Notes Concerning the Construction, Use and Management of Storage Batteries.

BY A. RECKENZAUN.

(*Continued.*)

In secondary batteries the storage of energy is effected without transmutation, that is to say, the battery receives when being charged an electric current, and gives it out in the same form, the activity of the plates depending entirely upon the electrical energy which has first been expended upon them. In primary batteries, on the other hand, electrical energy is manifested or produced by chemical means; many run-down primary batteries may be re-excited by sending a reverse current through them, when they become secondaries, but then their action is exceedingly limited, because the spent or decomposed acid cannot, by means of this excitement, be changed into its original composition, the limited secondary capability created by such a process of charging being mainly due to the gases occluded in the plates. The true secondary battery is Grove's gas-battery or voltameter, where the evolved gases furnish an electric current direct; it consists of two similar platinum electrodes, one of which is coated or in contact with hydrogen and the other with oxygen. The amount of oxygen which platinum can store or hold in suspension is exceedingly small, the metal itself not being oxidizable, though it has a great affinity for hydrogen. The use and advantage of an oxidizable metal for the purposes of electric storage therefore becomes manifest, and it has been found by Planté that lead plates are easily oxidized, whilst they are capable of retaining their energy for a very long time.

Capacity of Storage Batteries.—It seems that the energy which can be stored in a secondary battery is really a measure of the amount of oxygen and hydrogen taken up by the plates within the liquid. The liquid in the case of lead accumulators is dilute sulphuric acid. If we place two clean pieces of sheet lead, separated from each other, in a vessel containing acid, and if we send a current through them of sufficient intensity to decompose the liquid into its constituent parts, we then observe that one of the plates will soon be covered with a brownish film. This film is peroxide of lead; the oxygen has combined with the plate which was joined to the positive pole of the charging apparatus, and this plate is commonly called the *positive*. We next disconnect the terminals of the lead plates from those of the generator, and join them to a conductor capable of absorbing the current, placing a galvanometer in the circuit at the same time, in order to measure the current given off; this first discharge will be very feeble and of an extremely short duration, though the charging may have been going on for a long time. The fact is that we have stored oxygen whilst the hydrogen escaped; the negative plate, being clean and smooth, could not retain this gas, the storage of which must be effected by occlusion. If we now reverse the poles of this Planté cell and recharge it, the clean plate will be oxidized, while the oxide on the other will be gradually reduced to metallic lead of a porous consistency; the surface is thus no longer smooth, therefore capable of occluding *some* of the hydrogen, and its *capacity* has increased slightly. By many reversals of this kind the lead plates are deeply acted upon, and at last a considerable storage capacity is obtained.

Throughout these notes we shall frequently use the term "active material" in lieu of peroxide, spongy lead, or oxide paste, meaning only those parts of plates which have the power of absorbing the gases given off during electrolysis.

"*Forming.*"—Planté called his method of preparing lead plates "forming." It was a tedious and expensive process. Faure introduced an important improvement by coating the plates at once, mechanically, with a porous material, a paste of red lead; he obtained thus quickly a considerable storage capacity by merely peroxidizing the material on the positives, and at the same time reducing that on the negatives without any reversals. It really amounted to a thorough charging of the battery, although this first charge is also called "forming," because the oxide paste on the negative plates has to be reduced to metallic (spongy) lead before it can assume its full activity.

Originally, both the positive and the negative plates were pasted with red lead (Pb_3O_4), but it has been found that in the process of "forming" the positive material was peroxidized long before the paste in the negatives could be reduced to spongy lead; hence litharge (PbO) was substituted for minium in the negative plates, and this being a lower oxide, the requisite deoxidation could be effected with greater economy as regards energy and time. Further experience, however, showed that even with this distribution of different materials, the forming could not be completed at the same time in the negatives as in the positives, so that at last it became customary to form the negatives separately in special boxes containing "blind" positives; the energy expended in reducing litharge to spongy lead is at least twice that required for the peroxidation of red lead. The labor and care which such a double system of "forming" involves is not thrown away, indeed it is necessary for the preservation of the active material in the positive plates, which becomes extremely brittle if subjected to the same length of treatment as that of the negative plates.

Relation of Storage Capacity to Quantity of Active Material.—One ampère of current in doing the work of decomposing acidulated water releases ·000158 of a grain of hydrogen, and its chemically equivalent proportion of oxygen per second. "In this action the energy connected to one equivalent H 1 grain, O 8 = water 9, is measurable as 6,840 foot-pounds, and the electric conditions represent an E. M. F. of 1·5 volt." (Sprague's *Electricity.*) There being a definite relationship established between the current, time and volume of gas liberated, the capacity of an accumulator can best be measured electrically. In practice, for convenience, this capacity is expressed in ampère hours instead of ampère seconds, or coulombs; one ampère hour is equal to 3,600 coulombs. With regard to the amount of active material necessary for the absorption of given quantities of hydrogen and oxygen we find no reliable data suitable for immediate practical application. Chemical equivalents do not assist us, because in practice it is utterly impossible to distribute the materials in such a manner that every atom could do its duty. Gladstone and Tribe have made most elaborate experiments on the relative quantities of the two gases liberated and fixed with a given current and in a given time, but in their publications we find no exact description as to the weight or volume of lead acted upon. Since a free access of the electrolyte must be advantageous, it is perfectly natural to suppose that very thin plates, with a comparatively large surface, will give a greater storage capacity for given volume of active material than thick plates where diffusion is more difficult. We are, for mechanical reasons, forced to employ plates of a reasonable thickness, and with the aid of examples taken from well-known forms we may arrive at practical conclusions pointing to a maximum useful effect. The following figures bearing upon this question may be useful; the author has deduced these from exhaustive experiments made by him with accumulators of different types supplied by the Electrical Power Storage Company. Weights and dimensions refer to the active material (paste) only, and no account is taken of metallic supports:

(*a.*) *Cell used for locomotive purposes.*

Capacity, 150 ampère hours.

Weight of peroxide in positive plates	6.07	pounds.
Weight of spongy lead in negative plates	5.43	"
Total weight of active material	11.50	"

The capacity per pound of active material is therefore 13 ampère hours.

There are 23 plates in this cell, 11 positives and 12 negatives; the object of the odd number of plates is to have for all the positive plates in a cell two opposing negative surfaces. In each plate the active material consists of 560 small square slabs (square holes filled with paste); the free surface exposed to the electrolyte by these 560 tiny slabs, when counting both sides, is 53.7 square inches. The thickness of the positive plates is one-eighth of an inch, and of the negatives three thirty-seconds; the volume of peroxide in the positive plates is thus 36.9 cubic inches, while the spongy lead in the negatives occupies 30.23 cubic inches.

(TO BE CONTINUED.)

The Submarine Boat "Nautilus."

Recently, says the London *Electrician*, we had the pleasure of witnessing some experiments with the submarine boat "Nautilus," at the Tilbury Docks. The "Nautilus" is a cigar-shaped boat, built of steel, 60 ft. in length and 8 ft. in diameter amidships. She is propelled and steered by electricity. Elwell-Parker cells are employed, and the same firm supplied the switches and other electrical fittings. Two Edison-Hopkinson machines, by Mather and Platt, are used as motors, each machine driving one of a pair of twin screws, which are mounted directly upon the armature shafts, and run at 750 revolutions per minute. The number of cells is 104; they are divided into two separate batteries, one for each motor, and each yields 180 ampères at 100 volts for six hours. The boat is therefore provided with no less than 45 horse-power. The batteries weigh over 10 tons, and the motors very nearly a ton each. At a slow speed the boat can travel at least 75 miles without recharging the cells. The principle upon which the "Nautilus" can be submerged at will is that of displacement. Four large hollow cylinders fitted in stuffing boxes project from the sides, and can be drawn in or pushed out by manual power under the control of the crew. The advantage of this particular arrangement is that the vessel can sink either when running at full speed or when riding at her moorings, and whether motive power is ready or not. On going on board the boat we found the space below deck "cribbed, cabined and confined" even beyond what we had expected; a voyage of fifty miles on board such a craft would be anything but a pleasure trip. However, the "Nautilus" is designed for stern duties, and not for pleasure or comfort. One of the difficulties of submarine navigation is the impossibility of knowing in which direction to steer, except in an open sea (where, after her course has been laid on the surface, she has only to go straight ahead), and another is the difficulty of stopping or reversing the motion of the boat when once under way. These circumstances did not permit any speed trials to be undertaken in the Tilbury Docks. The boat crept about at a slow speed under water, and was steered by the aid of a telephone connected with a skiff which followed her movements.

Electricity at the Paris Exhibition of Sciences and Industrial Arts.

The "Jury superieur" of the Exhibition of Sciences and Industrial Arts, Paris, has awarded the following prizes (among others) to the exhibitors in classes 21 and 22 (Electricity, Telegraphy and Telephony):—Diplômes d'honneur—to the Banque d'Escompte, for Gaulard and Gibbs' electric transformers, which have partly contributed to the lighting of the Palais de l'Industrie, and have been otherwise applied for some months in France, at Tours, and abroad in several towns; to the Compagnie Edison, for the whole of its exhibits, machines and lamps for electric lighting purposes; a dynamo worked by a gas engine; a Pieper regulator; incandescence lamps; to MM. Thomson-Houston, for their electric machine established on original principles, and for their regulators, which have worked during the whole of the Exhibition; to M. Julien, for his application of accumulators to electric tramways, experimentally tried at Antwerp, and also at the Palais de l'Industrie, where a number of interesting observations were made; to M. Lodyguine (and his associate) for their studies and inventions relating to incandescence lamps. Gold medals—To M. Pulsford (representative) for the Phœnix dynamo machine for good construction; to the Société Anonyme d'Electricité, for their electric light installation, machines and lamps of M. Anatole Gerard; to MM. Woodhouse & Rawson, for their incandescence lamps and their models of electric lighting apparatus. The total number of prizes given were: Seven Diplômes d'honneur, 6 gold medals, 7 silver-gilt medals, 13 silver medals, 12 bronze medals and 7 honorable mentions.

Conference on the Protection of Submarine Cables.

The third conference on this question held its first séance at the Ministry of Foreign Affairs, Paris, on Dec. 1. Owing to the absence, through illness, of M. Granet, the Minister of Posts and Telegraphs, the conference was opened under the presidency of His Excellency M. de Albareda, the Spanish Ambassador to France. Our readers will remember that the first conference on this subject was held in Paris in 1884, and an International Convention was drawn up and signed on March 14 of the same year. This convention was to have come into operation on Jan. 15, 1886, but was postponed until Jan. 1, 1887, owing to the fact that many states had not legislated at all on the subject, and that others, notably Great Britain, had introduced a local legislation whose spirit was diametrically opposed to the decisions arrived at, and the laws agreed to, by the committee. At the conference assembled on the 12th of May of the past year final legislation on the matter was postponed until the present meeting, for the same reasons that previously delayed the settlement of the questions so long pending. The committee has now to examine into and report on the various laws on cable protection which have come into operation in foreign countries since the last convention. Among the subjects under discussion on the present occasion is the period at which the convention should definitively come into force. To this effect the delegates have been interchanging their views on the matter.

The Conference has adjourned until July 1st, some of the signatory States having not yet adopted the penal legislation which is intended to insure the execution of Article 12 of the Convention.

A New York State Lighting Commission.

In his message to the Legislature, Governor Hill proposes that a State gas commission be formed. After reviewing the recent agitations and investigations he says: "It is suggested that the public demand for the correction of any abuses which may still exist, and which have not already been entirely remedied, may be met by the passage of a measure, not local in its character, but providing for the appointment of a State commission, with power, under reasonable restrictions, to regulate and control the management of all gas companies throughout the State, to investigate all overcharges and other complaints; to report its recommendations to the Legislature, and, in general, to possess over gas companies powers somewhat similar to those which the Railroad Commission of the State has over railroad companies; such commission to be maintained without cost to the State, but at the expense of the gas companies, in a manner analogous to that in which the Insurance Department and the Railroad Commission are now supported. It is believed that such a measure, carefully perfected in its details, as its importance requires, and aiming to do exact justice between the companies and consumers, and protecting each in a fair and equitable manner, would meet with no opposition from any source, and relieve the Legislature from the annual clamor for special legislation, and at once afford a satisfactory solution of many difficult questions pertaining to this subject. The propriety of framing the proposed measure, so as to include within its provisions all electric and other lighting companies, is also suggested for your consideration."

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Jan. 3, 1886.

I hear that the great winter resort for the athletic millionaires and gilded youths of this city, Tuxedo Park, is to have a 600-light Edison plant. It will be run by a Straight Line engine 11 by 16. The light will do credit to Mr. Lorillard's sanitarium. I learn also that a 500-light plant is going in Lorenzo Reich's well-known wine house on Fifth avenue at Thirty-fifth street. The Edison plant at Stern Brothers dry-goods store on Twenty-third street is working splendidly. The motive power is supplied by new Watts & Campbell automatic engines. The Edison people take a good deal of pride in the plant, and the engineer of the firm speaks of it very highly. The Watts & Campbell Company, who are among the oldest builders of engines for electric lighting, have lately constructed a new improved Corliss engine at their Newark works, but as they prefer to do their good deeds in darkness, this fact may not be generally known to the electric lighting fraternity, who are all too busy to hunt up novelties, and must necessarily have them brought to their notice.

One of the best ways of enjoying a happy new year is to earn it, and it seems to me that it might be earned in many cases by the production of a higher class of goods. I have occasion in my rounds to hear frequent complaint about goods, and I have my attention often very forcibly directed to defects in construction and finish. A little more care, a little better material, a slightly smaller number of officers, and a slightly reduced dividend would all help to bring better trade, and, in the long run, higher returns. I hear grumbling in some quarters about bad trade, but all I have to say is that trade was never better for high class electrical goods.

I hear lots of talk about the American Exhibition in London this year—from May to November—and there can be no doubt that the Exhibition will be held. Indeed, I am informed that 1,500 exhibitors have already secured space, and that there will be several electrical specialties on view. Messrs. R. W. Blackwell & Co., 115 Broadway, are official general agents in the United States for exhibitors, and will be in personal attendance at the Exhibition. They have a number of patents and inventions to introduce and sell, and are prepared to take others in charge, with the object of disposing of them to the greatest advantage possible. All shipments from this side will be personally superintended by them.

Mr. A. L. Bogart, of Union Square, tells me that he never was busier than now in the electric gas lighting line, the force being kept busy night and day filling orders. One party took recently 4,000 burners. Mr. Bogart has two suits now pending to protect his patent rights, and says that a suit recently decided in Boston has a favorable bearing on one here.

The Electrical Supply Company, 17 Dey street, are manufacturing a full complement of copper for brushes of all widths and thicknesses, made of Lake Superior copper. The makers of dynamos and motors should certainly make it a part of their business to see this line, as well as the insulated copper wires carried by the company of all kinds and sizes. The company is rapidly developing its department for fitting up hotels, halls, steamers, offices, houses, etc., with electrical apparatus, and has in stock an endless variety of box bells, annunciators, electric gas lighting fixtures and other varieties of goods and appliances.

The Callender Insulating and Waterproofing Company made an arrangement lately with the Edison Machine Works, by which the latter offers the Callender cables for underground work on the same terms as tube feeders. The company has also opened a branch office at 12 Broad street, Boston, under Mr. Pentz, of Messrs. Sanderson & Son, and another at 422 Library street, Philadelphia, in charge of Col. Geo. W. Bratton.

Mr. Harry Hall, representing the American Electrical Works, is getting a good run of orders and reports the outlook as excellent.

I note the death in this city of Mr. Frederick Davies, Superintendent of the Central and South American Telegraph Company, who arrived in this city this week from Lima, Peru. Twenty years ago, when Sir John Anderson laid the first Atlantic cable, young Frederick Davies, a native of Wales, was one of the young electricians who accompanied this eventful expedition in its experiment across the vast deep. After the completion of the work, Mr. Davies was stationed at Valentia for a considerable time, as electrician in charge. He also, under the direction of James B. Stearns, carried into practical effect the duplex system of cables, and shortly after became connected with the Eastern Telegraph Company, which had its cables from England along the Mediterranean ports to the East. While stationed at Alexandria with Mr. Geo. G. Ward, now of the Commercial cables, during a period of extreme risk, when a violent epidemic of cholera was prevailing, Mr. Davies received great praise for never deserting his trying post a single instant. During the entire Chili and Peruvian war he was stationed at Lima as chief electrician of the Central and South American Telegraph Company, and his upright, energetic and manly conduct throughout these trying times led to his promotion to the position of superintendent. Mr. Davies leaves a widow and four children in Lima, who it is asserted will be well cared for by the officers of the company. The remains will be placed in a temporary vault until their removal to South America.

Mr. J. C. Frances, the secretary of the Waterbury Electric Company, of Waterbury, Conn., was in town last week. Their magneto which you described lately is having a big run. I do not think it has been at all overrated. A new motor will also be put on the market soon. W. T. H.

AUBURN, N. Y., Dec. 28, 1886.

The Auburn Electrical Supply Company, of whose starting by Messrs. J. C. Timpson and J. F. Adams you made mention in issue of Dec. 25, have already made their way to a good business. The offices and store are at 110 Genesee street. The Company deal in general electrical supplies, and make a specialty of fitting private houses, offices, hotels, etc. They are agents also for the Lee temperature regulator. Mr. Adams says as to the supply line: "Our specialty will be zincs and vitriol. We have a very fine 3¼ crowfoot that we can surprise buyers with, as to prices, and we can say the same as to vitriol."

The local Brush-Swan Company and Thomson-Houston Company have effected a consolidation, to take effect from the 1st prox., under the management of the Brush people, who have adopted the name of "The Auburn Electric Light Company." Mr. H. E. Chubbuck, who has managed the Thomson-Houston plant through all the strife, securing the city contract and a large share of the private arc and incandescent lighting, goes to Providence as electrician for the Narragansett Electric Light Company. He has won many friends here, who wish him success in his new field. The price of both kinds of light is to be raised, and the new company has every prospect of success, whereas it was "nip and tuck" between the competitors in a fight for rates that were not worth getting.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Jan. 3, 1887.

The Brookline, Mass., Electric Light Company is reported to have paid a quarterly dividend of 1½ per cent. Jan. 1.

A Brookline, Mass., organization known as the Electric Association gave their first annual ball and banquet on the evening of December 31.

It is said that Boston is to have a new theatre and that the present Public Library building is to be purchased and reconstructed for that purpose. It will be equipped throughout with electric lighting apparatus.

The Suburban Light and Power Company, of Brookline, Mass., recently organized for the purpose of furnishing electric lights and power, expects to have its plant completed and equipped before January 10.

The owners of the Warren Paper Mills, at Cumberland Mills, Maine, have purchased a complete electric lighting outfit for 800 incandescent and 20 arc lights.

The Amoskeag Manufacturing Company, of Manchester, has just finished its new mill, one of the largest buildings of the kind in New Hampshire. It will be furnished throughout with arc and incandescent lights.

At Norfolk, Mass., a society has been formed under the name of the Norfolk Improvement and Industrial Association. Among the commendable purposes contemplated by this organization is the raising of funds for supplying the town with electric lights.

The Greenfield, Mass., Electric Light and Power Company has been organized; capital, $10,000. Mr. John H. Sanderson is the President, and Mr. F. H. Harrison, Treasurer. The Thomson-Houston Electric Company has received the order for the arc-light equipment of the plant, and it is contemplated that the same company shall get the contract for furnishing apparatus for 300 incandescent lights.

Among the orders for electric lights recently filled by the New England agency of the Edison United Manufacturing Company (Messrs. Paine & Francis, Agents, Boston) are the following, viz.: A 300 incandescent light dynamo in Mr. J. F. Faxon's stores and offices on South street, near Essex, Boston, Mass.; a 200-light machine at the Cumberland Bone Company's factory, Boothbay, Maine; a 300-light plant for the Faulkner Manufacturing Company, North Billercay, Mass., and a plant at the mills of the Lincoln Pulp & Paper Company, Lincoln, Maine.

The New England Wiring Company, of Boston, has had charge of putting in the wires in the installations referred to.

Mr. P. H. Alexander, the New England agent of the Sawyer-Man Electric Company, reports having recently installed the following plants: At the Turner's Falls (Mass.) Paper Company, 53 incandescent lights; at the Forge Village Worsted Mills, Westfield Mass., 200 lights; at Abbot & Company's mills, Graniteville, Mass., 53 lights; in the residence of Mr. N. W. Waite, Sandy Hill, N. Y., 50 lights; and in the mammoth hardware establishment of Bigelow, Dowse & Company, Boston, 68 lights.

The number of electric lights (arc) now furnished the city of Malden, Mass., by the local electric light company is only 16, but it is a noticeable fact that these have displaced 38 gas lights and a number of oil lamps which formerly afforded very unsatisfactory illumination for the streets. The cost of the electric lights for the year will be $1,300, the company assuming all expenses for poles, wiring, and taking care of the lamps. It is predicted that the city authorities will soon give an order for an increase in the number of electric lights for street lighting.

It is said that Mr. F. D. Butricks, engine builder, of New Haven, Conn., is making for the Harlem (N. Y.) Electric Light Company two 150 horse power engines, and that these will be finished about January 15.

A new building, 100 × 60 feet, is being erected by the Bridgeport, Conn., Copper Company adjoining their present manufactory; and it is said that the company contemplate building a new rolling mill in the spring.

The Boston City Government, at its regular session, December 7, granted permission to the New England Telephone & Telegraph Company to lay underground conduits for wires in Pearl street, Atlantic avenue, Franklin, Broad, State, Commercial and Exchange streets, Dock square, Faneuil Hall square, Union, Marshall, Hanover, Blackstone, Endicott, Cooper, Charlestown, Haverhill and Causeway streets, Adams square, Brattle, Court, Sudbury, Cambridge and Charles streets.

Prof. Geo. H. Hartwell will give an electrical entertainment at Tremont Temple, Boston, on Wednesday evening, Jan. 12. Professor Hartwell is exerting himself to get up a programme which will eclipse all previous efforts on his part in the lecture field. Many new and attractive electrical subjects will be treated upon and illustrated, among which will be beautiful dissolving views by the electric stereopticon.

An important reform in the ringing of the fire-alarm bells of this city is to be inaugurated by the Fire Commissioners. There has heretofore been much complaint at the ringing of the bells all over the city for a trivial blaze in some remote locality. This is to be remedied by the commissioners. The clanging of the large church and school bells for every alarm, whether the fire be near by or in a remote portion of the city, has not only needlessly disturbed many citizens who would care nothing for a fire unless it was near enough to alarm them, but when the fire was in the central portion of the city has called to the scene large crowds, which have often seriously hindered the Fire Department in its work. So, since such alarms were unnecessary for the firemen, the commissioners have decided to follow the system successfully in use in New York, Brooklyn and Chicago. The tappers will be sounded as usual in the engine houses, and also the gongs, and the alarms will be given as usual in the police stations. It is not proposed to make the change at once, but to remove a few bells at a time until the entire city north of Dover street shall have no bell alarms.

"Messenger, messenger, who wants a messenger?" sang the juvenile chorus in Lydia Thompson's burlesque, "Oxygen." "Turkey, turkey, who wants a turkey?" sang forty boys at the Crawford House one day around Xmas time. They were the "trotters" of the United Lines Telegraph Company, and a merrier, jollier lot of lads it would be hard to find. Deliveries were for the time being forgotten, and each youth thought only of his fun and his fare. And indeed there was plenty of both. It is always customary to have the dessert at the close of the dinner, but on this occasion it came first in the shape of an elegant present to each of the boys, consisting of what they so very much needed, viz.: rubber boots, hats and coats. Under these circumstances it is no wonder that the party as they went down the bill of fare, from turkey and "fixins'" to assorted cake and ice cream, were unusually happy. At 2 o'clock they marched back to the office, ready for the emergencies of their calling, and with the kindliest feelings toward their employers and their many friends who so materially contributed to their comfort and convenience.

A member of the firm of Sowdon, Elder & Wright, New England agents for the American system, said last week: "Business is booming with us. The American system seems to be gaining ground every day, and those to whom we have sold are loud in their praise of it. Last week we received orders from the Somerville Electric Lighting Company, of Somerville, Mass., and from the Edison Illuminating Company, of Lawrence, Mass., for American plants, and in the case of the Somerville people, the initial order having proved entirely satisfactory, an additional set of apparatus has been ordered."

Houghton, Mifflin & Co. have as usual issued some remarkably fine calendars, combining beauty and utility with the greatest success. Each bears the portrait of a literary celebrity, gives choice passages from his writings and furnishes much valuable information as to measures of length, weight and capacity, rates of postage and other things that electrical men want to know about.

The Boston *Daily Globe* reports to its readers that "it costs only $2 a day to furnish the power for the electrical railroad at Toronto, Canada."

A question of authority has been raised by the Mayor's veto of the order to rescind the proviso relating to the police appropriation. When the appropriations were made last May, that for the Police Department was with the proviso that no part of the police appropriation should be expended for the police signal system which was then being introduced. At a recent meeting of the City Council an order was passed rescinding the proviso. Mayor O'Brien vetoed the order on the ground that the Board of Police had not obeyed the provisions of the original appropriation in that bills had been contracted by the board for carrying on the signal system. The Board of Police say in regard to this charge that Mayor O'Brien is not fully informed as to the facts. They say that the signal system was introduced as an experiment by the inventors, subject to approval or rejection by the board; that no contract of any kind was made, and that there was no stipulation as to the length of time to be devoted to the experiment. The only foundation for the mayor's charge lies in the fact that horses and carriages, now used in the system, have been introduced on that division. The board says in this connection that the carriages now used take the place of an ambulance and are greatly needed in that section of the city. It was the intention of the board to locate an ambulance on that division when the signal system was introduced. On that ground, therefore, the board claims that there was no violation of the restriction of the original order. But the board claims that the City Council has no right to place such a restriction on any appropriation for the Police Department, because it is no longer a city but a State department.

A reporter of the local *Transcript* has been interviewing some of the gas companies to know why they are going into the electric lighting business. The curious information is elicited that it is because the gas business is good and because more gas than ever is sold. One of the gentlemen believes that the great future of electricity lies in its use as a motive power, but electric light could never be the rival of gas, because it is liable to go out. I have heard that gas itself was liable to go out, explode, suffocate people, and so forth, but perhaps I am mistaken. Anyhow, I am glad to see our gas friends *practically* acknowledging the value and success of the electric light by going in for it. W. I. B.

HARTFORD, Conn., Dec. 27, 1886.

Preston C. Nason, the well-known telephonist, of Hartford, has laid aside his old watch and now carries what is, at first glance, a very innocent-looking affair, in the shape of a time-piece, that he recently obtained while traveling in the West Indies. Upon close inspection the new timer proves to be somewhat of a novelty, and it is "as full as a tick," for it gives the seconds, the minutes, the hours, the day of the week, the calendar date of the month, and the full lunar changes throughout the season. The arrangement of the latter is decidedly realistic. It is contained within the circle of the second hand, and composed of a sunk dial, inlaid with pearl, upon which is a miniature landscape, showing a bridge, an old mill, a river and sky, the whole being less than one-half inch in diameter, yet at the proper time, as arranged for this latitude, the tiny moon of burnished gold appears in the sky, passing in a circle from left to right, and making the gradual changes throughout the month, from the mere crescent to the full orb; then as gradually diminishing, day by day, only to return again in its full glory. When the moon, either in its greater or lesser magnitude, approaches the zenith of the heavens, an invisible shield is gradually withdrawn from the lower part of the landscape, exposing the reflections of the bright rays upon the rippling waters. The movement has a stem-wind and stem-set, and the phases of the moon, the day of the week, and date of the calendar, can be adjusted independently of the other works; yet, when once set, it will take care of itself from one year's end to another, provided it is kept wound. Notwithstanding its near approach to perfection, we suggested that there was one thing lacking to make it true to nature, and that was an occasional storm to obscure the moon; but Nason says this is fully arranged for, and the only thing required to produce a first-class disturbance in the heavens, is to "forget to wind up the dern thing." That would

do it; but in leap year it requires some little attention, for, like Mark Twain's frog, it won't leap. The combined mountings are also quite novel, the heavy crystal being set in a chased gold bezel, hinged to a corrugated body of silver, which, in turn, carries a hinged back composed of a silver centre with a heavy chased gold ring around the outer edge, making the case as unique as the works, and both in keeping with the owner. In fact, it is "three of a kind."

PHILADELPHIA NOTES.

PHILADELPHIA, Pa., Jan. 3, 1887.

The Seven States Improvement and Construction Company, whose office is at 422 Liberty street, own the right, by purchase, of eleven States, for the installation of the Hochhausen system of electric lighting, belonging to and manufactured by the Excelsior Electric Company. Several of these lights are running on Chestnut street, the wires being underground, there being in all about 130 of these lights in this city.

The present electrician of Philadelphia is Mr. David R. Walker, who has been connected with that office for over 30 years. He has made many and vast improvements in the electrical work of our city. Mr. Walker has personally superintended the work of putting up over 150 miles of telegraph poles, and knows the location of each of them as well as a schoolmaster would know his scholars. He has under his own supervision 500 signal boxes, 150 patrol boxes, 37 pole stations, 47 hook and ladder companies, and has at present 96 operators and after the first of the year will have 103. All of the electric lighting, telegraph and telephone companies must submit their plans for his approval before commencing operations. The Edison Incandescent Wiring Company will in a few days submit their plans to Mr. Walker for laying underground service.

Mr. Walker has fitted up his new electrical quarters in the most perfect and scientific manner. The battery room is 60 × 90, has 6 port holes and one large window, is heated by hot air and steam, and it is also provided with hot air flues; the ventilation is complete. There are five large eight-light chandeliers from the ceiling and two single-light and eight double-light brackets arranged along the walls at the sides. The floor is of concrete, being both fire-proof and water-proof. The facilities for cleaning the batteries, as regards water, are complete. There are two large soapstone sinks lined with lead, and provided with overflows to prevent any foreign matter from getting into the drain. These are both situated at the southern end of the room. The room is provided with a wardrobe for the use of the battery man and his assistant. There is a handsome hardwood case with French plate glass front, for the records of batteries, etc. The Leclanche battery is used. The cells are arranged on five rows of racks, each rack resting upon glass insulators. There are 1,000 cells set up, 950 of which are in actual use, the racks having capacity for 1,500 altogether. The cables run through a trap in the floor and run down the four sides of the wall. The other storeroom is about 85 × 50.

On the western side of the room is a wainscotted space for the various cables which are fanned out upon positive and negative binding posts. From this room all the batteries are cabled to the operating room, a large ground wire running through the centre of the board. These cables, all of 6-wire, will not all be in use at the same time, but only as occasion requires. The cables run from operating room through a glass duct for a distance of 110 feet to the northeastern stairway, and then down the walls to the cellars. The cables will all be inclosed, iron platforms being provided, which run from the cellar up, so that the cables can be attended to at any time without defacing the building. The cables in entering the building run through a conduit or alley, and then through asphalt troughs up the sides of the wall through the glass duct, and then enter a spring jackboard. They pass from that to fusible strips; from there to a lightning arrester; to the other side to fusible strips; from thence to the switchboard in the operating room, and finally to the instrument, returning the same way. The lightning arrester has 200 connections.

From where the cables leave the operating room to where they go down the walls is a distance of 110 feet. The run through which the cable goes on reaching the cellar is of asphaltum, with galvanized iron tops; from there, along troughs to a twenty-inch iron pipe that runs to a man-hole at Juniper and Filbert streets, and thence by a conduit to Juniper and Cuthbert streets, where it is run upon a pole and connected to the different lines. This conduit will be run up Broad street in the spring. There are 520 rooms in the public buildings, and they will all be connected with the electrician's room.

The Penn Company have received the permission of Councils for laying an underground service on South street; they have commenced operations, but have had to stop on account of the weather. They will resume their work again as soon as possible. Their conduits are 6 × 8 on the outside, in three divisions. The Postal Telegraph Company have also obtained permission for laying their underground system from Third and Chestnut to Lancaster avenue and the County line, a distance of about five or six miles. The long distance telephone service operated by the American Telephone and Telegraph Company has 9,000 feet of Kerite cable drawn; the lines have been introduced into several brokers' offices and hotels.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Jan. 1, 1887.

A very important piece of underground work has just been finished in this city, and it has interested not only electricians, but the public as well. Speaking of the operations the local *Tribune* says: "For the last week or ten days people of an inquisitive turn of mind have had ample food for conjecture in the appearance upon certain of the leading down-town thoroughfares of some very mysterious paraphernalia about which small gangs of workmen hovered, seemingly in no wise perturbed by the throngs of interested onlookers who gathered from time to time to witness operations. The set of mechanical appliances that stood in front of the *Tribune* office, just south of the Madison street crossing, on Dearborn street, for a couple of days last week attracted nearly every pedestrian who passed that way, and it is possible that nine out of every ten who paused to reconnoitre moved on just as wise as they were when they stopped. The central point of observation was a tent, about five feet high by perhaps four wide, standing directly over a hole in the roadway, or 'manhole,' as it is called. Out of this hole was seen to be slowly issuing a wire rope, which, through the medium of a sort of capstan, manned by three or four stout fellows in top-boots and flannel shirts, wound itself into a shining coil, while the end, taut as the halyard of a schooner under full sail, never relaxed its grip on some invisible object beneath the surface. A little further away there stood a big, smoking, black tank, very similar to those used for boiling tar when a bit of new street pavement is in course of construction. The men seemed very busy, and, while perfectly content to be watched, appeared indisposed to answer questions. The movements of those about the capstan and tank were in a measure monotonous and devoid of interest; what was going forward within the confines of the tent was of course unknown and mystifying. To explain the matter it may be briefly said that the men were employés of the Chicago Telephone Company engaged in putting down a section of its Dearborn street underground cables."

I can supplement this by some figures and facts. Some time last June the Chicago Telephone Company obtained the right to use what is known as "the oil system" in Chicago, Cook County, and adjoining counties in Illinois and Indiana. They then made arrangements for laying wires underground on a scale hitherto unknown. The "oil," or Brooks system, is so well known that I need not go into details about it, but the conditions of work were decidedly novel. It was necessary to have a cauldron made specially for the purpose. This cauldron consisted of an iron tank, in which was a large drum, capable of holding 1,000 feet of 510-wire cable, the conductors of which were No. 16 American gauge. The cauldron was provided with a chimney and a furnace for heating the oil, and when placed on wheels weighed 5,975 pounds. It was soon found that the carriage, or running gear, was insufficient to carry that weight with cable and oil added, and stronger gear had to be employed. The cable weighed 5½ pounds to the foot. To cover this cable took seven barrels of oil—the oil used being heavier than water.

This plant was started from the main telephone exchange, corner of Calhoun place and Lasalle street, with three 3-inch diameter iron pipes. The pipes are laid in a wooden box made of 1½ inch plank, except the cover, which is two inches thick. At the time the pipes are put in the box, the space not occupied by them is filled with a concrete made of sand and pitch, thrown in while hot, rammed so as to pack closely, and then smoothed over the top with a trowel before the cover is spiked on. The object of the concrete is to protect the iron pipe from rust. At the corner of Calhoun place and Dearborn street, one of the pipes is intended to branch; the two others extend up Dearborn to Jackson, and one is intended to proceed up Jackson. The other goes east of Jackson until it reaches Victoria alley, and goes up that to Twentieth street, along which it runs across Wabash and Michigan avenues, to the corner of the alley in the rear of the Calumet Club house. Thence it proceeds southward to the sub-exchange on Twenty-second street. The length of this pipe from the main exchange is $2\frac{7}{10}$ miles. This single pipe may be called a centre leg. There are no wires taken out for service until Jackson street is reached between State and Dearborn. There 50 wires are brought through the cellar of the building, at 81 Jackson street, to be carried up to the roof and thence distributed to subscribers. The remaining wires continue to the alley between Van Buren and Jackson, and Wabash and State, and there 50 more are taken off and carried to the roof of the Blatch building. The wires are taken off in this way in groups of 50 to 100, until we get to about midway between the two exchanges, where there are only 100 wires for 2,000 feet. Then they increase again until 250 are brought into the Twenty-second street sub-exchange.

The box in Lasalle street, before referred to, is about 14 inches wide and 18 inches deep. It will be seen that these three pipes have a capacity of 1,530 conductors. Where there are but two pipes, the box is proportionately smaller, and still smaller with but one pipe. The pipes are laid about 3 feet below the surface.

The work was finished on the night of December 23, and on the next morning the test of 100 through conductors was made for inductive disturbance and "cross talk," but not the faintest indication of anything of that kind could be observed. The first impression in beginning to talk was that the other speaker had his mouth too close to the transmitter. But after this had been attended to the articulation was astonishingly clear.

It is a singular fact in connection with this work that it was done entirely by the employés of the Chicago Telephone Company, who had never had any experience in that kind of work. Another point is that a large part of it was done in the night, after dark, amidst rain and snow. The tents referred to above were for the splicers working in the night time, when the thermometer stood at from 8 to 12 below zero. Two men, with a stove to keep themselves warm, were placed at a splice-box—the "manholes" on the 510-wire cables being 500 feet apart—and the two men would make 500 splices in 4 hours. The cables were made by the Western Electric Company to the special order of the telephone company, and tested at an insulation resistance of 40 megohms to the mile, which in warm weather would be about 15 to 20. The pipe was furnished by the Allison Manufacturing Company, of West Philadelphia, and the splice-boxes by Stanley G. Flagg & Co., of Philadelphia.

A local writer pertinently remarks that if half the companies that have been incorporated for the purpose build elevated railroads over this city, we shall have to run rubber tubes up between them to get air enough to breathe down on the ground. It is true that a great many different people have taken the trouble to get from the Illinois Secretary of State licenses to organize elevated railroad companies in Chicago. But this is usually as far as the matter goes. On December 22d, however, Anson H. Lawrence, Edward R. Cahill and George A. Dupuy, commissioners to open books of subscription to the capital stock of the Chicago West Division Elevated Railroad, reported to the Secretary of State that the capital stock, amounting to $10,000,000, has been subscribed, as follows: W. Weston, $8,000,000; Edward D. Coles, S. N. Warren, Charles E. Warren, and James R. Walther, each $500,000. The election of the following as a board of directors for the first year is certified to: Anson H. Lawrence, Edward S. Dreyer, and Jacob F. Rehm. A certificate of final incorporation was accordingly issued by the Secretary of State. The company proposes to construct, maintain, and operate an elevated way from some point between Lake Michigan and the south branch of the Chicago River, and between Lake street and Harrison street, in the city of Chicago, to a point on the west line of Cook County, Illinois, between the lines of said two streets extended west, with the following branches leading therefrom: One to Humboldt Park, one to the stock yards, one to Douglas Park, and one to the corner of Western avenue and Blue Island avenue. This company has got further along, and the project looks more like business than anything which I have noticed for some time in the elevated railroad line. There are some good names among the directors, and plenty of money is represented. Indeed, it is claimed that the Philadelphia syndicate, which lately purchased the North Side Street Car Company's system, is back of the company, and if this should prove to be the case, it can be set down as certain that the new project means business, and that it will not be allowed to lag. I shall be disappointed if this new company does not do something more than simply get itself incorporated. Chicago needs elevated railroads very badly, and the company which has the capital and enterprise to go ahead and build them, and propel the cars by electricity, will surely reap a harvest.

The new wholesale dry goods building of Marshall Field & Co. in this city, will be lighted by the arc system of the Western Electric Company. The building covers an entire block, bounded by Fifth avenue, Adams, Franklin and Quincy streets. The plant furnished by the Western Electric Company will run 180 full arc lights.

I hear that Julius Andraes is putting a 440-number annunciator guest call and fire alarm in the Plankinton House, Milwaukee. It is on the Hess system of the Standard Electrical Works of Cincinnati.

W. A. K.

VINCENNES, Ind., Dec. 29, 1886.

The continued success of the Heisler system of electric lighting in this town may make it of interest to relate the manner in which it came to be introduced here. It will be remembered, as described in a recent number of THE ELECTRICAL WORLD, that the system consists of running incandescent lamps in series. The city council of Vincennes did not look favorably upon the plan to light the city by arc lamps, on account of the large number of shade trees on the streets and also on account of the large extent of territory, which included several suburbs, to be lighted, making a circuit of over 15 miles. Besides, the electric light had to be furnished over that area at a price not to exceed the cost of a certain number of gas lamps which would have been required at the one hundred intersections.

The Vincennes people hesitated a long while until finally, attracted by the report of the success of the St. Louis Illuminating Company, they concluded to examine into the Heisler system by sending a committee of investigation to St. Louis. Mr. Heisler had by this time advanced so far in his work as to furnish lights of 30, 45 or 60 candle-power to nearly a hundred different places, on a No. 7 wire, irrespective of distance. They found the lights located, varying in number from one to one hundred, in club rooms, in hotels, in all sorts of stores, in private dwellings and on the streets. An investigation of the conditions of the St. Louis Company showed that the Heisler system allowed of a remunerative business, even when competing with gas at the rate of $1.50 and $1 per thousand feet. After concluding its negotiations with the Heisler Electric Light Company, the committee found itself enabled to lay before the council a proposition which was at once accepted by a unanimous vote. The result can be told in a few words. The Electric Light and Power Company, of Vincennes, Ind., supplies an incandescent light of 30 candle-power for the street at the rate of $24 a year, while the gas in the centre of the city is being paid for at the rate of $36 per 16 candle-power flame. The company supplies 300 lights, half of them to the city, the other half to various private customers, and has an expense of only one dollar's worth of fuel per night! The incandescent lamps are placed in series and give general satisfaction by their brilliance and steadiness.

THE TELEGRAPH.

T. M. B. A.—Assessment No. 203 for $1 has been made to meet the death claims of James N. Kerr and Luther C. Field. During last month about 100 new members were enrolled.

A Busy Time.—It was almost impossible to get a messenger in the up-town District Telegraph offices Saturday evening, as the lads had to be pressed into service for the delivery of delayed telegraphic messages. Two-thirds of the messages delivered were New Year's greetings, sent here from all over the country.

Compliments of the Season.—The government staff at Edinburgh, Scotland, sent to the Western Union office at 195 Broadway a very tasteful and pretty card, conveying the best wishes of the season. On it were painted also a view of the Castle and a spray of heather. The card was greatly admired at 195 when posted up for general inspection.

A Timely Interchange.—On Jan. 1 the Boston office of the Baltimore & Ohio Company having received a telegram of good wishes from Mr. E. A. Leslie, general superintendent, New York, sent an answer through Mr. C. J. Sheehan, thanking him for his complimentary references to them and asking his acceptance of their wishes in return.

The Nantucket Cable.—Lieut. I. H. Weber, of the United States Signal Corps, has successfully repaired the cable across Vineyard Sound, cut by the steamship "Wilkesbarre" some time since. The work of securing the cable and splicing it in two places proved a very difficult undertaking, requiring eight days of constant labor. The expense to the Government for this work will reach the sum of $600. A sign, with letters of unusual size, has been placed at both landing places, and can be plainly seen for a long distance out in the Sound.

Greetings from Australia.—We are in receipt of a remarkably pretty Christmas greeting from the officers of the Central Electric Telegraph office, Melbourne, Victoria. It is a large folder bearing lithographed sketches by O. Dobson and M. W. Fitzgerald, both operators. On the first page are kangaroos writing the dispatch of good wishes. The two inside pages show a large map of Australia, the space for each colony being occupied by a typical scene. On the back page are views of the Houses of Parliament, Law Courts, Post and Telegraph Office and Princes Bridge in Melbourne. The whole is signed by W. B.

Edwards, Hon. Secretary. A neater card of its kind we have never seen.

Delaying a Dividend.—A dispatch from Montreal of Jan. 3 says: Some days ago the Board of Directors of the Montreal Telegraph Company advertised that they would pay the regular dividend on Monday, Jan. 3. To-day an advertisement appeared in the morning papers announcing that as the directors had not received the money from the Great Northwestern Telegraph Company the dividend could not be paid. The Montreal Telegraph Company's advertisement implies that the Great Northwestern has broken its agreement, and speaks with confidence of the ultimate payment of the dividend. The stock fell to 98, or about 10½ per cent., from the prices of Friday last. Many operators believe that the directors of the Montreal company have by advertising the dividend made themselves liable for it, and the investors in the stock since the dividend was advertised talk of holding the directors liable for their losses.

Why the Wires were Down.—Referring to the recent stoppage of telegraph business in England by the storm, a dispatch from Berlin of December 30 says: "The newspapers here complain of what they call England's culpable negligence in failing to adopt subterranean telegraph lines to connect with the submarine cables, the result of which failure was the total telegraphic isolation of London in the recent storm. They express the hope that this experience will lead to the adoption of the German system in England." Another dispatch of December 31 says: "The *North German Gazette* attributes the collapse of telegraphic communication between England and the Continent during the recent storm to the cupidity of the submarine telegraph monopoly. It expresses the hope that the English Government will acquire control of the cables."

THE TELEPHONE.

Evansville, Ind.—The City Council has filed its second suit against the Cumberland Telephone and Telegraph Company, to cause the company to vacate the streets and alleys.

In the South of England.—Hard as it is to believe, it is nevertheless the fact that in the busy seaport of Southampton there were only four telephones a year ago. The West Counties Company is now making a change, however, in this anomalous condition of things, and has already secured about 50 subscribers for its exchange.

The Massachusetts Suit.—Counsel for the government in the telephone case are hard at work preparing the bill to be filed in the Massachusetts suit, which will be brought directly against the Bell Company at Boston, "as there are no subordinate companies in Massachusetts." Otherwise the bill will be similar to that filed by the government in the Columbus suit. It is expected that the papers will be printed next week and sent to District Attorney Sterns, at Boston, who will file them. Judge Nelson, of the District Court, and Judge Colt, of the Circuit Court, will try the case. It is not yet known whether or not Justice Gray, of the Supreme Court, whose circuit includes Boston, will take part in the hearing, which will probably be set down for the spring term, beginning in May next.

Iowa Taxation.—The State Executive Council has fixed upon the valuation of the telephone property in the State, and assessed the several companies, all of which have headquarters in Davenport, as follows: The Iowa Union Telephone Company, at Davenport, $53,281, three per cent. of which is assessable for taxation. This valuation yields a revenue of $1,598.40. The Iowa and Minnesota Telephone Company was valued at $16,000, consolidated with the Iowa Union, and assessed $480 taxes. The Central Union, at Davenport, at $40,000, and taxed at $1,200. The Nebraska Telephone Company was valued at $7,000, and assessed at $210. The telephone companies have heretofore had a valuation placed upon them by local assessors, but under a recent decision of the Supreme Court this method has been changed, and they now come under the same law taxing telegraph companies. The change is based upon a decision rendered in the case of the Iowa Union Telegraph Company *vs.* The City Council of Oskaloosa as a board of equalization.

The Rochester Poles.—The following is from Rochester, N. Y., of Jan. 3: "Judge Rumsey has handed down his decision in the case of the Bell Telephone Company against the city of Rochester. His findings are a complete victory for the Subscribers' Association. The temporary injunction obtained by the Bell Company is vacated and the application for a permanent injunction denied. The case was unimportant in itself, but important as a test. The case was over the erection of a new pole on Court street. Despite the protests of the Executive Board the pole was erected. The grounds for the objection were that its erection was unnecessary, and that as the company's franchise had been revoked by the Common Council the company had no right to erect any further poles. The Executive Board thereupon ordered the obnoxious pole taken down, but the Bell Company obtained a temporary injunction restraining the city from interference. The case was argued two weeks ago, and the result is the decision above announced. The Bell Company held that the city could not revoke a franchise once given, but Judge Rumsey holds that the city cannot give a perpetual right to blockade and obstruct the streets."

THE ELECTRIC LIGHT.

Fayetteville, N. C., wants it, and means to have it.

Winchester, Va., has a company organized for electric lighting.

Fremont, O.—The city council proposes adopting electric lights.

Savannah, Ga.—The local Brush Company's dividend declared Dec. 29, is $3 a share.

Philadelphia, Pa.—The local Edison Company has a capital of $100,000. The treasurer is Mr. P. F. Kelly.

Hawaii.—The royal palace is now lighted by electricity, and Honolulu is soon to have an electric light plant.

Fort Dodge, Ia.—The Fort Dodge Electric Light Company has a capital stock of $25,000. The president is Mr. L. Blanden.

Irwin, Pa.—The Irwin Electric Light and Power Company has been formed, with a capital of $10,000. Mr. P. S. Pool is the treasurer.

Hempstead, L. I.—The Hempstead Gas-light Company has secured a franchise to illuminate the village of Hempstead with electricity.

Greenfield, Mass., will pay about $1,800 for street lighting, and for lights in Washington Hall. The new company gets the contract.

Maine.—The Saco and Biddeford Electric Light Company, incorporated with a capital stock of $10,000, has Mr. Seth Warren as president.

Detroit, Mich.—The new station for the local Brush Company, on Foundry street, will be two stories in height. It will cost $26,000.

Meriden, Conn.—The Meriden, Conn., Electric Light Company, incorporated by A. Chamberlain and others, has a capital stock of $35,000.

Buffalo, N. Y.—The Buffalo Electric Light & Power Company has been incorporated by Mr. C. G. Curtis and others, with a capital stock of $10,000.

Chattanooga, Tenn.—The company lately organized to erect an electric-light plant at Chattanooga, Tenn., will have a capital stock of $100,000.

Lyons, Kan.—Mr. Seth Warren, of Biddeford, Me., is the president of the Lyons Electric Light & Power Company, which has incorporated with a capital of $30,000.

Birmingham, Ala.—Mr. Leigh Carroll is President and Mr. Stanhope Jones Vice-President of the Edison Electric Manufacturing Company that has been organized at the above place.

Asheville, N. C.—J. G. Martin, J. E. Rankin, W. T. Penniman and F. A. Hull have incorporated the Asheville Electric Light Company with a capital stock of $15,000 to manufacture electricity and ice.

Fitchburg, Mass.—A new industry is about to be established in Fitchburg by the recently organized Fitchburg Manufacturing Company. The company's specialties will be steam engines, small electric light plants, etc.

Aberdeen, Miss.—The Aberdeen Electric Light Company, Aberdeen, Miss., have reorganized with W. P. Timberlake as president, and have increased their capital stock. The capacity of their plant will probably be doubled soon.

Alabama.—Another new town is to be started four miles from Birmingham, Ala., with a contributed capital of $10,000,000. It will have water and gas works and electric lights, and large manufacturing establishments will be built at once.

Minneapolis, Minn.—Mr. Geo. D. Moulton, superintendent of the St. Anthony Elevator Company, has put in a 200-light United States machine, and has fitted up the elevator also with electric call bells, a complete electric fire-alarm system, and with the American District Telegraph watchman's signal and direct fire-alarm system. This work has had his special attention, and is understood to be about as good as anything can be, in the milling line, or any other, for that matter.

Nashua, N. H.—The Nashua Gaslight Company is to erect in the company's yard a building to contain an electric light plant, the company having decided that if the residents of Nashua desired electric light instead of gas that it will be ready to furnish it. This the company would have done before, had a desire on the part of citizens been expressed in favor of electric lighting. The new building, which is to be of brick, will be built on the latest improved pattern, and filled with the best machinery for producing electricity for lights. The plant will have three dynamos, which will be driven by two engines.

Pearl Fishing.—A steam yacht named the "Chic," belonging to a well-known firm of Glasgow engineers, is said to be lying at Port Glasgow for the purpose of being fitted with a Brush dynamo and electric light equipment, to be used in the process of pearl fishing on the South Australian coasts. The lamps are enclosed in strong glass globes, specially made to withstand the heavy pressure, and it is expected that successful use will be made of them at as great a depth as seventeen fathoms. Diving is not usually carried on otherwise at more than about seven or eight fathoms, so that a decided improvement is hoped for in the pearl fishery.

Medford, Mass.—At the meeting of the Medford Board of Selectmen on Dec. 27, Mr. M. F. Dwyer, to whom was granted the privilege of lighting the town with electricity, reported that he had not succeeded in organizing a company in Medford, but he had made an arrangement with the Malden Electric Light Company, which would put up poles under the direction of the selectmen and establish a plant at once. An application was received from the Gray Electric Dynamo Machine Company, of Boston, for the privilege of doing the same thing, and Mr. Gray made a personal appeal to the board to delay action for two weeks, in order that it might witness one of his machines in operation. He said he could save the town 50 per cent. As the board had previously granted Mr. Dwyer the privilege, it didn't entertain Mr. Gray's proposition. Mr. Dwyer said his company would begin operations at once, and a committee was appointed to place the poles in position.

A Skowhegan Man Has It.—A Skowhegan electrician has invented a new electric light, which he is confident will revolutionize electric lighting all over the world. He has been fostering his electric scheme and burning midnight oil for over a year. The light is now perfected and patents in America, England, Germany, France and Russia have been applied for. This invention is creating quite a stir where it is understood. The new light was tested in the Skowhegan electric light station one evening not long since, and it is said its superiority over the ordinary arc system was apparent to many of the citizens of Skowhegan who were eye-witnesses to the experiment. The light is produced by a spiral carbon, entirely different to anything heretofore used by electricians. It is claimed that this new electric light will produce a brighter light than has yet been found. It is what is called the mechanical feed. It is claimed by the inventor that not only is his light brighter than electric light nowadays, but there will be no quivering, flickering, or hissing to the new light, of which greater things are predicted than have heretofore seemed possible in the realm of the electric light.—*Lewiston (Me.) Journal.*

APPLICATIONS OF POWER.

Tramway Construction.—The Electric Tramways Construction and Maintenance Company has been formed in England, with a capital stock of $1,250,000, to operate under the Holroyd Smith patents.

Boston and Brookline.—Hearings have been given by the local Brookline authorities to the West End Railway Company, which proposes to put a street railway down between that place and Boston. Either electricity or cables will be used, and in all probability the former.

The Third Avenue Road.—The experts who have been examining the feasibility of electric motors for the Third avenue surface road have reported that such a motive power is entirely practicable. The only question now seems to be one of expense. It will be a fortunate thing for New York if the company finds an efficient electrical system that will be cheap enough for its purpose. In that event we may hope to see the city rid at no very distant day of horses as a motive power on street car lines. To get rid of the many thousands of horses so employed would add to the cleanliness and health of the city, and be a great gain in the way of saving unnecessary suffering to animals.—*New York Tribune.*

PERSONAL.

Mr. Thomas A. Edison has been ill with a slight attack of pneumonia at his house in Llewellyn Park, Orange, N. J., but is now reported to be beyond all danger.

Mr. O. S. Wood, an old telegraph official, now living at Clifton S. I., has made a Christmas gift of $100 to the reserve fund of the Telegraphers' Mutual Benefit Association.

Mr. H. Kingsford.—The Council of the Society of Telegraph Engineers and Electricians of England have awarded the Fahie prize to Mr. H. Kingsford, engineer and electrician of the Central and South American and Mexican telegraph companies (formerly electrician of the repairing steamer "Mackay-Bennett"), for his paper "On the Localization of Faults in Submarine Cables." We recently called attention to some very successful work in cable repairing performed by Mr. Kingsford in South America, and congratulate him on the high honor he has attained in connection with this very important subject.

Lord Brassey.—It will be remembered that Lord Brassey was among us lately, taking notes. In an article in the *Nineteenth Century* he says of New York: "The leading thoroughfares are lined with buildings often of noble proportions. From an architectural point of view, all the effects are completely destroyed by the telegraph and telephone companies. Huge posts of fir are planted on both sides of the great thoroughfares carrying hundreds of wires, which interlace at every crossing. It is a monstrous abuse to permit these appliances of civilization to be carried above ground. Subways should be formed for the purpose."

MISCELLANEOUS NOTES.

A Storage Company.—The Electric Storage, Light and Power Company, of East St. Louis, Ill., has been incorporated by S. L. Trippe and others, with a capital stock of $1,000,000.

The Splitdorf Insulated Wire Company, of Brooklyn, N. Y., has been incorporated by Henry Splitdorf and others, with a capital stock of $10,000.

"Its Wonderful Growth."—THE ELECTRICAL WORLD publishes a pleasant little pamphlet, all about itself and its wonderful growth. It is very interesting and well worth keeping. We remember *The Operator*, in its early days, very well. It was always bright and saucy.—*Light, Heat and Power.*

Electric Clocks in Venezuela.—An export house in Stuttgart has just supplied to the town of Caracas, in Venezuela, a number of clocks for the public streets. On account of frequent earthquakes, clock towers are not advisable, and since the clocks must be placed low, a comparatively large number is required. Among the clocks sent out is one with a dial 13 feet in diameter. All the clocks will be worked electrically, and illuminated at night with the electric light.—*Industries.*

Electrification of Ice by Water Friction.—In some recent experiments by L. Sohncke a jet of water was caused to play against a sheet of ice at a certain angle. It was then found that the lower part of the jet was electrically positive to the water which had just struck the ice. In most cases water becomes positively electrified by friction with a solid. The author considers that his results are opposed to Edlund's theory, in which the usual + electrification is ascribed to the straining of the ether caused by the forward motion of the stream of liquid. Tin, steel and glass, when rubbed upon ice, produce a + charge in the latter.

An Ocean Signal Service.—The signal service office in Washington is to be placed in charge of Mr. John P. Finley, who will undertake to execute a plan for making an international ocean signal service. The intention of the Washington office is to take a section of the North Atlantic, between 40° and 70° west longitude and 35° and 50° north latitude and prognosticate the weather therein. All vessels going to and from the ports of France and England and the United States pass through that section. The direction and velocity of storms therein will be noted and prognosticated, and the results sent by cable to British and French seaports. The same kind of service in France and England will be rendered for the benefit of the United States. The result will be a more precise knowledge of meteorological conditions before steamers on either side of the Atlantic shall leave their several ports for ocean voyages.

Mill Magnets.—Referring to the use of magnets in flour mills, a milling journal says: "Probably one-half the magnets sold to millers are practically worthless for use in flour-mills. When tested, they prove to be insufficiently charged, and hence have but limited power to attract pieces of metal. A good ten-inch magnet should be able to lift a twelve-pound weight and hold it, but we have seen many that would not hold one pound.

The steel for a reliable magnet must be of even and close grain, by no means soft, for its power depends on this in a measure. It not infrequently happens that two pieces of steel of the same rolling will make magnets of different strengths, and it is only by years of study and experience that a manufacturer can be sure of always producing well-charged magnets. He has to go through with many experiments, using different grades of steel, before he can tell which is best for his purpose. It is, therefore, not to be expected that a good separator can be had for a song, although its price is not beyond the means even of the small miller."

Rather "Rocky."—A very peculiar property has recently been discovered in the rock of a mountain seven miles from the town of Santa Cruz. This rock is heavily charged with electricity, and when applied to a battery was found to produce strong electric currents. A small handful of this rock applied in a battery generated sufficient electric force to operate the battery for three weeks, and appeared not to be the least exhausted of its powers. This rock has very much the appearance of ordinary soapstone, and exists in immense quantities, constituting the principal mass of the mountain. Its strange property was accidentally discovered by a man who was experimenting with mineral water on the mountain, and who, having occasion to use some of this rock, placed it in contact with the battery. The man who made this wonderful discovery kept it a profound secret from the world until he and one or two of his confidential friends had obtained a title to the portion of the land, paying $15,000 therefor. The present owners are now experimenting with this rock with a view to thoroughly testing its properties.—*Tulare, Cal., Free Press.*

SPARKS AND FLASHES.

They Make It Up.—The Manchester *Mirror* says the telephone is again becoming popular in that city. It is to be presumed that the young lady at the central office has had a spat with the young gentleman with whom she has heretofore been in the habit of monopolizing the wires.

"Jest Drop it Down."—An old lady, whose ideas of the electric current are a trifling vague, accosted a telegraph pole climber as he sunk his spurs into the wood.

"Say, mister, are you goin' up?"

"Yes."

"Well, if there's a telegraphy message from my son John up there, jest drop it down, will ye? I'm expecting of him home."—*Judge.*

The Maligned Meter.—Man—"I come to tell you about my gas meter. For the last three months——." Gas office clerk—"Yes, we know all about it. You've been out of town and all the pipes have been sealed, yet the meter registers 13,274 feet. You'll have to pay it all the same." Man—"You are mistaken, sir. I have burned gas all over the house, and the meter only registers sixteen feet. I thought I'd notify you of the discrepancy." Clerk—"I—I—why, sir"——[Falls dead].—*Philadelphia Call.*

BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolts, cap and set screws, taps, dies, files, twist drills, brass and rubber in tubing, rod and sheet copper, brass, German silver steel and iron wire, shafting tools, etc.

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, member New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

January 4, 1887.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	25	35
Am. Tel. & Cable	74	76
Cen. & So. Am.	75	100
*Com. Tel.	103	.....
*Gold & Stock	90	95
*Inter. Ocean Tel.	85	.....
N. Y. Mutual	73	.....
Pac. & Atl.	48	55
*Postal T. & C.	.....	.....
South. & Atl.	66	75
W. U. Tel.	72⅜	72⅛
W. U. Scrip.	65	.....
W. U. Bonds	.....	122
Mut. U. Bonds	85	85½
TELEPHONE.		
Am. Bell	197	198
Am. Speaking	112	125
Erie	27½	28
*Hudson River	53	60

TELEPHONE.	Bid.	Asked.
Mexican	1½	1⅝
*N. Y. & N. J.	.....	93
N. Y. & Pa.	.....	.....
New England	44	44½
*Southern Bell	110	130
ELECTRIC LIGHT.		
*Am. Electric	.....	.....
*Brush	.....	.....
*Brush Ill.	.....	.....
*Consolidated	.....	.....
*Daft	.....	.....
*Edison	150	.....
*Edison Ill	85	.....
*Edison Isolated	100	.....
*United States	35	.....
*U. S. Ill.	95	100
MOTOR.		
*Daft	.....	.....
*Sprague	600	.....

* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

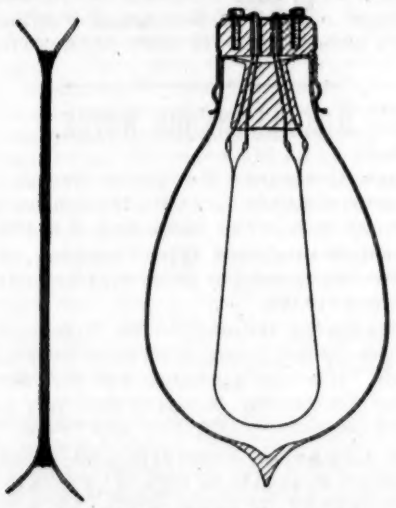
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED DEC. 21, 1886.

354,530. Electric Lamp; H. R. Boissier, New York, N. Y. Application filed June 7, 1886. The object is to make the lamp so that the feeding of the carbon is wholly under the control of the high resistance or shunt helix, so that if a number of lamps are arranged in series on a circuit in which the current varies to an appreciable extent the lamps shall be so sensitive in working that they may be controlled by a very small portion of the current. See illustration

354,538. Dynamo-Electric Machine or Motor; C. G. Curtis and F. B. Crocker, New York, N. Y., Assignors to the C. & C. Electric Motor Company, New York, N. Y. Application filed March 4, 1886. The invention consists in improved methods of constructing arma ures for dynamos or motors, such that the parts may be made almost entirely by machinery.

(1) 354,539, (2) 354,588. Dynamo-Electric Machine and Electric Motor; S. S. Wheeler and C. G. Curtis, New York, N. Y. Assignors to the C. & C. Electric Motor Company. Application of (1) filed July 21, 1886, and application of (2) July 14, 1886. Both inventions relate to details of construction of the C. & C. motor described in THE ELECTRICAL WORLD, Oct. 2, 1886.



354,788. INCANDESCENT LAMP.

(1) 354,541 and (2) 354,542. Telephone Transmitter; Daniel Drawbaugh, Eberly's Mill, Pa., Assignor of (1) to the People's Telephone Co., New York, N. Y. Both inventions relate to novel forms of carbon transmitters. In the first, solid carbon is employed, and in the second carbon in a granulated form. Application of (1) filed November 12, 1883; application of (2) September 8, 1886.

354,606. Electrical Distributor; R. H. Mather, Windsor, Conn. Application filed July 15, 1886. The distributor is designed to be inserted in an electric circuit of constant current for the purpose of producing in a second circuit, which is fed from the first, a constant electromotive force.

354,637. Electro-Magnetic Boiler Cleaner; G. W. Hart, Quincy, Ill. Application filed May 13, 1886. The object of the invention is to prevent the formation of scale in boilers. It consists in obtaining the desired magnetic effect upon the interior parts of the boiler by carrying one pole of the magnet through the shell, at the same time inserting a magnetic substance between the shell and the pole, whereby the shell is magnetically separated from the pole. See illustration.

354,639. Electric Lamp; Charles D. Jenney, Indianapolis, Ind. Application filed October 27, 1885. The invention relates to double lamps. The object is to produce such a lamp in which both the carbon-holding rods will be supported at all times when the lamp is in operation by the magnets, together with other details of construction.

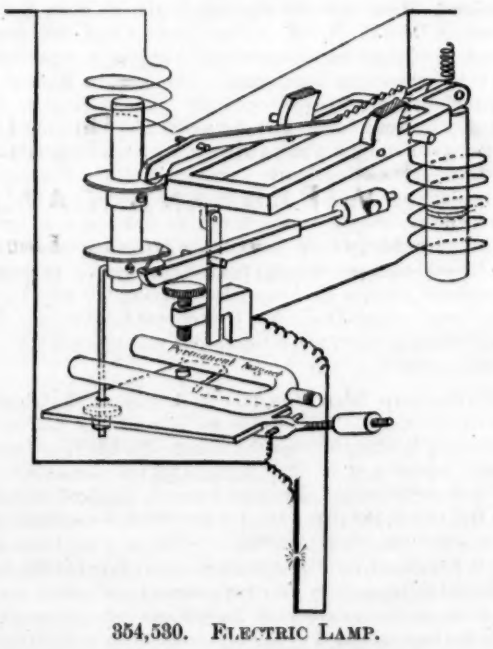
(1) 354,758. Mast or Tower; (2) 354,759. Mast-Arm; (3) 354,760. Reflector; John S. Adams, Indianapolis, Ind., Assignor of all three to the Jenney Electric Co., same place. (1) Consists of a central pole with vertical trusses placed radially, and other details. For illustrated description, see THE ELECTRICAL WORLD, May 8, 1886. Application filed May 4, 1886. (2) Consists of details of construction of mast-arm for the support of arc lamps in streets. Application filed May 4, 1886. (3) The invention consists in the combination of an electric arc light and a reflector arranged around and upon a higher plane than the light. The reflecting surface is formed convex from top to bottom and arranged at such an angle that some portion of each section shall face the light directly at all times. Application filed May 18, 1886.

354,761. Non-interfering Street-Box for Fire-Alarm Telegraph Systems; Alexander Anderson, Toronto, Ontario, Canada. Application filed February 6, 1886. The invention consists in providing each box with mechanism so arranged in the circuit that the opening of a box while any other box in the circuit is striking disconnects the winding mechanism from the starting hook, thereby effecting non-interference.

354,847. CUT-OUT FOR ELECTRIC ARC LAMPS.

(1) 354,781. Electric Lighting; (2) 354,782. Means for Lighting Railway and other Signal Lanterns by Electricity; (3) 354,783. System of Electric Lighting; J. E. H. Gordon, Kensington, County of Middlesex, England. (1) For description see page 18, this issue. Application filed August 21, 1886. (2) The invention consists in apparatus for lighting the lamps of railway signals by incandescent lamps. In order to guard against the light in such signal lanterns from being extinguished, means are provided for instantly indicating the extinction of a lamp and for relighting by means of a spare lamp, together with other safety devices. Application filed August 21, 1886. (3) He employs two sets of mains throughout the system, but, instead of one wire of a certain section, using two wires each of one-half that section. These wires are so arranged that in each room or building half the lamps are in one system and half on the other, so that if any interruption occurs in the supply in either system only every alternate light is extinguished. Application filed Aug. 23, 1886.

354,788. Incandescent Lamp; A. S. Hickley, Groton, Conn., Assignor to the Jenney Electric Company, Indianapolis, Ind. Application filed June 18, 1886. He employs two or more substances, such as animal fibre, vegetable fibre and spun glass woven together, and then carbonizes the whole. The lamp has two sets of interior terminals. See illustration and paper read by inventor before the National Electric Light Association, entitled "Carbons for Incandescent Lighting," THE ELECTRICAL WORLD, Sept. 11, 1886.



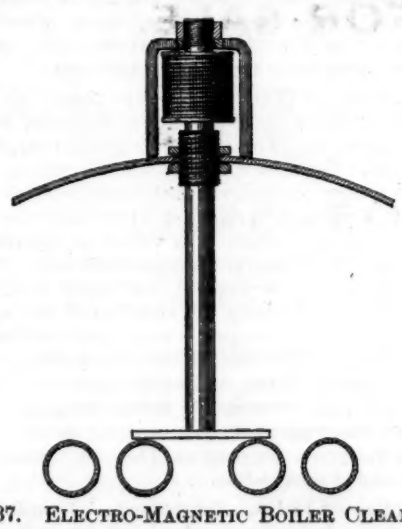
354,530. ELECTRIC LAMP.

354,791. Regulator for Dynamo-Electric Machines; J. H. Irwin, Morton, Pa. Application filed March 2, 1886. The regulation is effected by altering the relative surface of action of the armature and magnetic field by withdrawing the armature more or less from between the poles.

354,793. Electric Motor for Railways; Walter H. Knight, Cleveland, Ohio. Application filed May 11, 1885. The invention consists in the combination of two electric motors in the same circuit and connected to a common lead, the motors each having means for shifting their commutator brushes and a common device for actuating them.

(1) 354,814. (2) 354,815. Telegraph Instrument; Josef Steiner, Brooklyn, Assignor to Haskins & Steiner, New York, N. Y. Application of both filed July 31, 1886. Both inventions relate to the manner of supporting the lever on telegraph sounders by means of a flat resilient spring. Invention (2) can also be applied to telegraph keys.

354,818. Telephone Transmitter; W. L. Voelker, Morton, Penn. Original application filed March 16, 1880. Divided, and this application filed Dec. 27, 1880. The electrodes consist of dissimilar metals, one of refractory material, such as platinum, and the other of soft iron, brass, or other non-refractory body, which is fusible at a much lower temperature than the other.



354,637. ELECTRO-MAGNETIC BOILER CLEANER.

354,827. Railroad Signal; G. D. Burton, New Ipswich, N. H. Application filed March 19, 1886. The object of the invention is to provide means whereby the engineer of a train will be automatically notified when any of the cars become detached.

354,838. Electrical Pumping Apparatus; M. A. Michales, Allegheny, and Albert Michaels, Pittsburgh, Pa. Application filed Aug. 20, 1886. The invention consists in improvements in pumping apparatus, including electric motors and generators.

354,847. Cut-out for Electric Arc Lamps; N. C. Walter, West Point, Assignor of one-half to G. B. McAdams and Roland Hill, both of Richmond, Va. Application filed Aug. 18, 1886. The invention consists in placing a string or wire of fusible metal in such a position that when the carbons have burned to a certain point the heat from the arc will sever the wire or string, which releases a contact spring which cuts the carbon out of circuit. See illustration.

354,856. Annunciator and Alarm Signal; J. W. Frost Rochester, N. Y. Application filed March 11, 1886. This is an improved annunciator and signal box, with testing circuit-closers to be used in connection with electric systems for announcing and preventing fires.

354,858. Electric Circuit Closer; John Geary, Philadelphia, Pa., Assignor of one-half to J. E. Shaw, of same place. Application filed August 30, 1886. The invention relates to "door springs" for electric burglar alarm and other circuits. Consists in various details of construction to insure certainty of electrical contact.

10,791. (Reissue.) Electric Fire-Alarm or Thermostat; Chas. E. Kells, Jr., Assignor by mesne assignments to the National Automatic Fire-Alarm Company, New York, N. Y. Application filed Aug. 26, 1886. Original number, 322,612, July 21, 1885. The thermostat consists of a concave disc with flattened edge held in a support so as to expand on the application of heat.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.